Alaska LNG

BIOLOGICAL ASSESSMENT

2015 GEOPHYSICAL & GEOTECHNICAL PROGRAM IN THE WATERS OF COOK INLET

USAI-EX-SRZZZ-00-000006-000

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EXECUTIVE SUMMARY

The Alaska Gasline Development Corporation, BP Alaska LNG LLC, ConocoPhillips Alaska LNG Company, ExxonMobil Alaska LNG LLC, and TransCanada Alaska Midstream LP plan to construct one integrated LNG Project (Project) with interdependent facilities for the purpose of liquefying supplies of natural gas from Alaska, in particular from the Point Thomson Unit (PTU) and Prudhoe Bay Unit (PBU) production fields on the Alaska North Slope (North Slope), for export in foreign commerce. Proposed Project facilities include a Liquefaction Facility on the eastern shore of Cook Inlet in the Nikiski area of the Kenai Peninsula, which will be supplied by an approximately 1,287-km (800-mile), large diameter natural gas pipeline from the North Slope (Mainline). The Liquefaction Facility is comprised of an LNG Plant and Marine Terminal.

The natural gas pipeline would include an offshore section crossing the Cook Inlet; however, the selection of the actual routing and detailed engineering design is still in process. To inform selection of the appropriate route, the 2015 summer program will evaluate an approximately 45-km (28-mi) long by 13-km (8-mi) wide Mainline pipeline survey area across Cook Inlet to the proposed Liquefaction Facility location. Results from the 2015 study program will be incorporated into detailed engineering designs of the final route selection and submitted in an application for export of liquefied natural gas (LNG) under Section 3 of the Natural Gas Act.

Marine geophysical and geotechnical (G&G) surveys are proposed to be conducted in 2015 to investigate the technical suitability of the pipeline survey area across Cook Inlet and the proposed Marine Terminal location near Nikiski. Two G&G survey areas are subsequently described, with both the pipeline survey area and marine terminal survey area collectively considered the “Action Area” for purposes of this assessment. The G&G surveys will use acoustical equipment to collect most of the necessary data, some of which has the potential to acoustically harass marine mammals, and intrusive sampling equipment (grab, coring, boring) that could affect habitat. Harassment is a form of “take” as defined under both the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA).

On behalf of the Alaska LNG Project, ExxonMobil Alaska LNG, LLC (EMALL) has applied for an Incidental Harassment Authorization (IHA) from the National Marine Fisheries Service (NMFS) for their Cook Inlet 2015 G&G Program. Because this authorization constitutes a federal action, consultation under Section 7 of ESA is required beginning with the development of a Biological Assessment (BA) addressing the potential effects of the action to listed animals, including humpback whales (*Megaptera novaeangliae*), Cook Inlet beluga whales (*Delphinapterus leucas*), and Steller sea lions (*Eumetopias jubatus*). The U.S. Army Corps of Engineers (USACE) has requested that NMFS designate EMALL their non-Federal representative to conduct Section 7 consultation.

The planned geophysical surveys involve the use of remote sensors including a single-beam echo sounder, multi-beam echo sounder, sub-bottom profilers (chirp and boomer), 0.983 L (60 in^3) airgun, side-scan sonar, geophysical resistivity meters, and a magnetometer to characterize the bottom surface and subsurface. The planned shallow geotechnical investigations include vibracoring, sediment grab sampling, and piezo-cone penetration testing (PCPT) to directly evaluate seabed features and the soil conditions along the pipeline survey corridor and within the Marine Terminal survey area. Geotechnical borings are planned at the potential shoreline crossings and in the terminal boring subarea within the Marine Terminal survey area, and will be used to collect information on the mechanical properties of *in-situ* soils to support feasibility studies for construction crossing techniques and decisions on siting and design of pilings, dolphins, and other marine structures. Geophysical resistivity imaging will be conducted at the potential shoreline crossings. Shear wave velocity profiles (downhole geophysics) will be conducted within some of the boreholes.

Geophysical and geotechnical surveys that do not involve equipment that could acoustically harass listed marine mammals could begin as soon as May 2015, depending on the ice conditions. These include echo sounders and side-scan sonar surveys, operating at frequencies above the hearing range of local marine mammals, and geotechnical borings, which are not expected to produce underwater sound pressure levels exceeding ambient. The remaining surveys, including use of equipment that could potentially harass marine mammals (sub-bottom profilers, the small airgun, and the vibracorer), would occur soon after receipt of the IHA.

Occurrence of both the humpback whale and Steller sea lion in the Action Area would be considered very rare because these species are more commonly found in lower Cook Inlet. Consequently, there are no density estimates specific to the Action Area for either species, and the potential number of animals that could be exposed to harassment level noise is less than one. Further, critical habitat has not been designated for humpback whales, and Steller sea lion critical habitat does not occur in the Action Area.

Nearly all of the Action Area falls south of Cook Inlet beluga whale Critical Habitat Area 1, the region most important to summering beluga whales; thus, significant numbers of summering beluga whales are not expected to occur within the Action Area. The number of beluga whales that could potentially be exposed to harassment level noise, without implementing shutdown mitigation measures, was estimated at seven based on the Goetz et al. (2012) beluga density model. A small (28.5 km^2/11 mi^2) portion of the pipeline survey area does occur within Critical Habitat Area 1, however no sub-bottom profiler or vibracorer activity is planned within 5 km (2.7 nm) of the Beluga River.

The Cook Inlet 2015 G&G Program will result in a number of minor discharges to the waters of Cook Inlet including the discharge of drill cuttings and drilling mud, and the discharge of deck drainage (runoff of precipitation and deck wash water) from the drilling platform. EMALL has applied for an Alaska Pollutant Discharge Elimination (APDES) Individual Permit for these discharges, including requests for zones of deposit (ZOD) and mixing zone (MZ) for drilling mud and cuttings. No sanitary/domestic wastewater discharges will occur from the drilling platform. All wastewater will be captured onboard and sent to shore for proper processing and disposal.

Project activities that could potentially impact marine mammal habitats include sediment sampling (vibracore, boring, grab sampling) on the sea bottom, and placement of the jack-up rig spud cans. However, the impact areas are very small and there are few benthic resources in the survey area.

This assessment determines that the proposed G&G project ***May Affect, but is Not Likely to Adversely Affect*** humpback whales because while the proposed geophysical activities do produce noise levels that could acoustically harass humpback whales, the noise levels are so low and the zones of ensonification are so small that relative to the rarity of humpback whales occurring in the Action Area, the risk of Level B harassment exposure is insignificant. Further, shutdown mitigation measures will be implemented should humpback whales be detected during these surveys.

This assessment determines that the proposed G&G project ***May Affect, but is Not Likely to Adversely Affect*** Steller sea lions because while the proposed G&G activities do produce noise levels that could acoustically harass Steller sea lions, the noise levels are so low and the zones of ensonification are so small that relative to the rarity of Steller sea lions occurring in the project area, the risk of Level B harassment exposure is insignificant. Further, the closest Steller sea lion haulout sites and rookeries are more than 160 km (100 mi) south of the Action Area, and mitigation measures (e.g., shutdowns) will be implemented should Steller sea lions be detected during the surveys. The nearest Steller sea lion critical habitat (the 20-mile buffer around Nagahut Rocks) is also nearly 137 km (85 mi) south of the Action Area. The G&G project will have no effect on Steller sea lion critical habitat.

This assessment determines that the proposed G&G project ***May Affect, But is Not Likely to Adversely Affect*** Cook Inlet beluga whales because of the possibility that a small number of beluga whales (based on summer densities in the Action Area) could be exposed to noise associated with the proposed G&G activities. Mitigation measures will be implemented throughout the duration of the project to reduce beluga whale exposure to noise associated with the geophysical activity, including vessel-based monitoring, safety radii, power-down procedures, shutdown procedures, ramp-up procedures, and speed or course alteration. Further, nearly all of the Action Area occurs outside Critical Habitat Area 1 (beluga summer habitat) and no sub-bottom profiler or vibracorer activity will occur within 5 km (2.7 nm) of the Beluga River. Finally, the proposed G&G Program is not expected to adversely affect the Cook Inlet beluga whale critical habitat because direct modifications to habitat (e.g., borings and spud can placement) are considered to be insignificant.

1.0 THE PROPOSED ACTION

1.1 PURPOSE OF THE PROPOSED ACTION

The Alaska Gasline Development Corporation, BP Alaska LNG LLC, ConocoPhillips Alaska LNG Company, ExxonMobil Alaska LNG LLC, and TransCanada Alaska Midstream LP plan to construct one integrated LNG Project (Project) with interdependent facilities for the purpose of liquefying supplies of natural gas from Alaska, in particular from the Point Thomson Unit (PTU) and Prudhoe Bay Unit (PBU) production fields on the Alaska North Slope (North Slope), for export in foreign commerce. Proposed Project facilities include a Liquefaction Facility on the eastern shore of Cook Inlet in the Nikiski area of the Kenai Peninsula, which will be supplied by an approximately 1,287-km (800-mile), large diameter natural gas pipeline from the North Slope (Mainline). The Liquefaction Facility is comprised of an LNG Plant and Marine Terminal.

The natural gas pipeline would include an offshore section crossing the Cook Inlet; however, the selection of the actual routing and detailed engineering design is still in process. To inform selection of the appropriate route, the 2015 summer program will evaluate an approximately 45-km (28-mi) long by 13-km (8-mi) wide Mainline pipeline survey area across Cook Inlet to the proposed Liquefaction Facility location; this corridor and the Liquefaction Facility (including the Marine Terminal of 371 km^2 {143 mi^2}) are depicted in Figure 1. Results from the 2015 study program will be incorporated into detailed engineering designs of the final route selection and submitted in an application for export of liquefied natural gas (LNG) under Section 3 of the Natural Gas Act.

Marine geophysical and geotechnical (G&G) surveys are proposed to be conducted in 2015 to investigate the technical suitability of the pipeline survey area across Cook Inlet and the proposed Marine Terminal location near Nikiski. The G&G surveys will use acoustical equipment to collect most of the necessary data, some of which has the potential to acoustically harass marine mammals, and intrusive sampling equipment (grab, coring, boring) that could affect habitat. Harassment is a form of "take" as defined under both the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). On behalf of the Alaska LNG Project, ExxonMobil Alaska LNG, LLC (EMALL) has applied for an Incidental Harassment Authorization (IHA) from the National Marine Fisheries Service (NMFS) for their Cook Inlet 2015 G&G Program. Because this authorization constitutes a federal action, consultation under Section 7 of ESA is required beginning with the development of a Biological Assessment (BA) addressing the potential effects of the action to listed animals, including humpback whales (*Megaptera novaeangliae*), Cook Inlet beluga whales (*Delphinapterus leucas*), and Steller sea lions (*Eumetopias jubatus*). On behalf of the Alaska LNG Project, EMALL is submitting this BA to fulfill that requirement.

1.2 PROJECT AND ACTION AREA

The Cook Inlet 2015 G&G Program will include geophysical surveys, shallow geotechnical investigations, and geotechnical borings. The Action Area consists of two separate areas (Figure 1) that will be investigated: the Pipeline survey area and the Marine Terminal survey area. The survey areas are larger than the eventual pipeline route and the Marine Terminal site (which includes an LNG carrier approach zone) to ensure detection of all potential hazards, or to identify areas free of hazards should the corridors/sites need to be adjusted to avoid existing hazards.

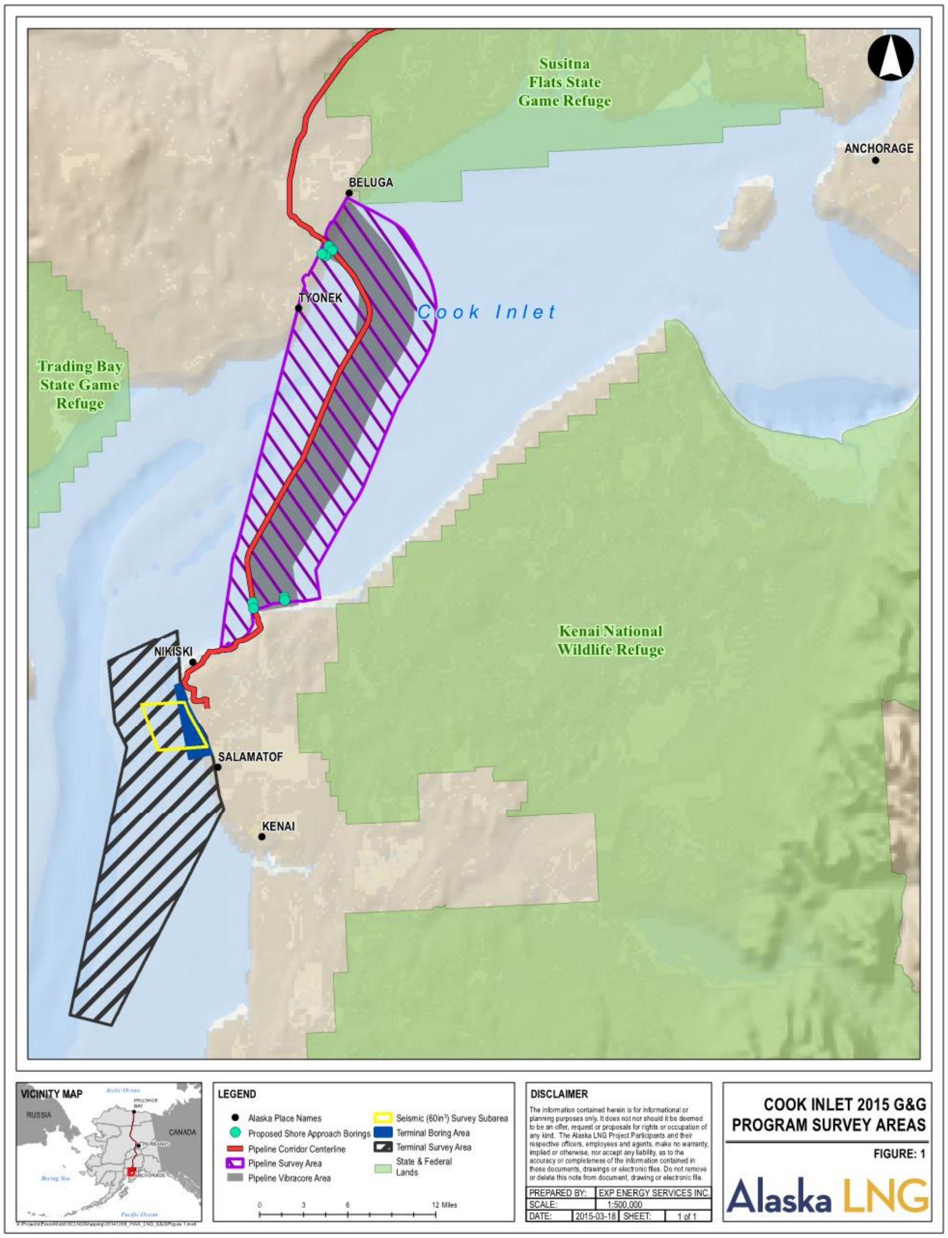
Pipeline Survey Area – The Pipeline survey area (Figure 1) crosses Cook Inlet from Boulder Point on the Kenai Peninsula across to Shorty Creek about halfway between the village of Tyonek and the Beluga River. The Pipeline survey area is approximately 45 km (28 mi) in length along the corridor centerline and averages about 13 km (8 mi) wide. The total pipeline survey area is 541 km^2 (209 mi^2) and contains one subarea, the pipeline vibracore area.

Marine Terminal – The Marine Terminal survey area (371 km^2 {143 mi^2}) is located near Nikiski (Figure 1) where potential sites and vessel routes for the Marine Terminal are being investigated and includes two subareas: an airgun survey subarea (25 km^2 {8.5 mi^2}) and a terminal boring area (12 km^2 {4.6 mi^2}).

1.3 DESCRIPTION OF THE PROPOSED ACTION

The planned geophysical surveys involve the use of remote sensors including a single-beam echo sounder, multibeam echo sounder, sub-bottom profilers (chirp and boomer), 0.983 L (60 in^3) airgun, side-scan sonar, geophysical resistivity meters, and magnetometer to characterize the bottom surface and subsurface. The planned shallow geotechnical investigations include vibracoring, sediment grab sampling, and piezo-cone penetration testing (PCPT) to directly evaluate seabed features and the soil conditions along the pipeline survey corridor and within the Marine Terminal survey area. Geotechnical borings are planned at the potential shoreline crossings and in the terminal boring subarea within the Marine Terminal survey area, and will be used to collect information on the mechanical properties of *in-situ* soils to support feasibility studies for construction crossing techniques and decisions on siting and design of pilings, dolphins, and other marine structures. Geophysical resistivity imaging will be conducted at the potential shoreline crossings. Shear wave velocity profiles (downhole geophysics) will be conducted within some of the boreholes. Further details of the planned operations follow.

Figure 1. Cook Inlet 2015 G&G Program survey areas.



1.3.1 Dates and Duration of Action

Geophysical and geotechnical surveys that do not involve equipment that could acoustically harass listed marine mammals could begin as soon as May 2015~~, depending on the ice conditions~~. These include echo sounders and side-scan sonar surveys, operating at frequencies above the hearing range of local marine mammals, and geotechnical borings, which are not expected to produce underwater sound pressure levels exceeding ambient. The remaining surveys, including use of sub-bottom profilers and the small airgun, would occur soon after receipt of the IHA.

1.3.2 Geophysical Surveys

The types of acoustical geophysical equipment planned for use in the Cook Inlet 2015 G&G Program are indicated, by survey area, in Table 1. The magnetometer and resistivity system are not included in the table as they are not acoustical in nature and thus do not generate sound that might harass marine mammals, nor do they affect habitat. The downhole geophysics are included in the table as a sound source, but are not considered further in this assessment as the energy source will not generate significant sound energy within the water column because the sound source will be located downhole within the geotechnical boreholes.

Table 1. Proposed locations for use of acoustic geophysical equipment planned for use in the Cook Inlet G&G Program.

Survey Equipment		Survey Area [2]	
Type	**Model [1]**	**Pipeline**	**Marine Terminal**
Single-Beam Echo Sounder [3]	Echotrac CV-100	+	+
Multibeam Echo Sounder [3]	Sonic 2024	+	+
Side-Scan Sonar [4]	EdgeTech 4125	+	+
Sub-bottom Profiler (Chirp)	EdgeTech 3200	+	+
Sub-bottom Profiler (Boomer)	Applied Acoustics AA301	+	+
Downhole Geophysics [5]	PS-logging	+	+
Airgun	Secel Mini GI 0.983 L (60 in^3)	-	+[6]

[1] A similar model may be used
[2] A (+) indicates the equipment will be used in the survey area, a (-) indicates it will not
[3] Equipment is described below but not further assessed because frequencies are beyond marine mammal hearing ranges
[4] Equipment not further assessed in this document as it is not acoustical
[5] Equipment not further assessed in this document because the sound source in downhole
[6] Operated in seismic subarea only

A description of the other types of geophysical equipment proposed for the 2015 Program that will generate impulsive sound in the water column follow, and they are evaluated further in this assessment as to potential impacts to listed marine mammals. Information on the acoustic characteristics of these geophysical sound sources is summarized in Table 2, followed by a corresponding description of each piece of equipment to be used.

Table 2. Acoustical characteristics of geophysical and geotechnical equipment planned for use in the 2015 G&G Program.

Type	Model [1]	Operating Frequency (kHz)	Source Level [5] (dB re 1 μPa-m [rms])
Single-Beam Echo Sounder	Echotrac CV-100	>200 [2]	146 [6]
Multibeam Echo Sounder	Sonic 2024	>200 [2]	188 [6]
Side-Scan Sonar	EdgeTech 4125	400-1600 [2]	188 [6]
Sub-bottom Profiler (Chirp)	EdgeTech 3200	2-16 [2]	202 [7]
Sub-bottom Profiler (Boomer)	Applied Acoustics AA301	0.5-6 [2]	205 [7]
Airgun	0.983 L (60 in^3)	<1 [3]	206 [8]
Vibracore	Alpine	0.01-20 [4]	187 [4]

[1] A similar model may be used
[2] Source: Manufacturer brochure
[3] Source: Richardson et al. 1995
[4] Source: Chorney et al. 2011
[5] rms = root mean square
[6] Shores 2013
[7] Manufacturer provided peak value converted to rms (using a -10 dB offset)
[8] O'Neill et al. 2010

1.3.2.1 Single-Beam Echo Sounder

Single-beam echo sounders calculate water depth by measuring the time it takes for emitted sound to reflect off the seafloor bottom and return to the transducer. They are usually mounted on the vessel hull or a side-mounted pole. Given an operating frequency of more than 200 kHz (Table 2), sound energy generated by this equipment will be essentially beyond the hearing range of marine mammals in the Action Area (Wartzok and Ketten 1999, Southall et al. 2007, Reichmuth and Southall 2011, Castellote et al. 2014). Further, single-beam echo sounds operate at relatively low energy levels (146 dB re 1 μPa-m [rms]). Therefore, this equipment is not further evaluated in this assessment.

1.3.2.2 Multi-beam Echo Sounder

Multi-beam echo sounders emit a swath of sonar downward to the seafloor at source energy levels of 188 dB re 1 μPa-m (rms). The reflection of the sonar signal provides for the production of three-dimensional (3-D) seafloor images. These systems are usually side-mounted on the vessel. Given the operating frequencies of the planned multi-beam system (>200 kHz, Table 2), the generated underwater sound will be beyond the hearing range of Cook Inlet marine mammals in the Action Area (Wartzok and Ketten 1999, Kastelein et al. 2005, Southall et al. 2007, Reichmuth and Southall 2011, Castellote et al. 2014). Additionally, most sound energy is emitted directly downward from this equipment, not laterally. The multi-beam echo sounder is not further evaluated since the operating frequency exceeds the maximum hearing frequency of local marine mammals.

1.3.2.3 Side-scan Sonar

Side-scan sonars emit a cone-shaped pulse downward to the seafloor at a source energy of about 188 dB re 1 μPa-m (rms). Acoustic reflections provide a two-dimensional (2-D) image of the seafloor and other features. The equipment may be hull-mounted or towed behind the vessel. The side-scan sonar system planned for use during this program will emit sound energy at frequencies of 400 and 1,600 kHz (Table 2), well beyond the normal hearing range of Cook Inlet marine mammals (Wartzok and Ketten 1999, Kastelein et al. 2005, Southall et al. 2007, Reichmuth and Southall 2011, Castellote et al. 2014). As such, side-scan sonar is not further evaluated in this assessment.

1.3.2.4 Sub-bottom Profiler – Chirp

The chirp sub-bottom profiler planned for use in this program is a precisely controlled "chirp" system that emits high-energy sounds with a resolution of 1 millisecond (ms) and is used to penetrate and profile the shallow sediments near the seafloor. It is designed to be towed behind ~~a~~ the vessel within the top two meters of the water column. The equipment will be used with a repetition rate of 300 ms, approximately 6 times per second. At operating frequencies of 2 to 16 kHz (Table 2), this system will be operating at the lower end of the hearing range of beluga whales and Steller sea lions, and well within the hearing range of humpback whales (see 4.2.4), but well below the most sensitive hearing range of beluga whales (45-80 kHz, Castellote et al. 2014). The source level is estimated at 202 dB re 1 μPa-m (rms).

1.3.2.5 Sub-bottom Profiler – Boomer

A boomer sub-bottom profiling system with a penetration depth of up to 600 ms and resolution of 2 to 10 ms will be used to penetrate and profile the Cook Inlet sediments to an intermediate depth. The system will be towed behind the vessel within the top two meters of the water column. The equipment will be used with a 3.125 m shot interval, and approximately 1.5 – 2.0 seconds per shot. With a sound energy source level of about 205 dB re 1 μPa-m (rms) at frequencies of 0.5 to 6 kHz (Table 2), most of the sound energy generated by the boomer will be at frequencies that are well below peak hearing sensitivities of beluga whales (45-80 kHz; Castellote et al. 2014), but would still be detectable by these animals. The low frequencies of this equipment are well within the effective hearing range of humpback whales (Richardson et al. 1995) and at the lower peak hearing range of Steller sea lions (1–16 kHz; Kastelein et al. 2005).

1.3.2.6 Airgun

A 0.983 L (60 in^3) airgun will be used to gather high-resolution profiling at greater depths below the seafloor. The equipment will utilize a 6.25 m shot interval, and approximately 3.5 seconds per shot. The manufacturer's (Sercel) published source level for a 0.983 L (60 in^3) airgun is 216 dB re 1 μPa-m (peak) equating to about 206 dB re 1 μPa-m (rms). These airguns typically produce sound levels less than 1 kHz (Richardson et al. 1995, Zykov and Carr 2012), or below the most sensitive hearing of beluga whales (45-80 kHz; Castellote et al. 2014) and Steller sea lions (1–16 kHz; Kastelein et al. 2005), but within the functional hearing of these animals (>75 Hz; Southall et al. 2007). This low-frequency noise source is well within the hearing range of humpback whales. The airgun will only be short term and used only during geophysical surveys conducted in the smaller seismic survey subarea within the Marine Terminal survey area.

1.3.3 Geotechnical Surveys

Planned geotechnical surveys include geotechnical borings and shallow geotechnical investigations consisting of vibracores, sediment grab samples, and PCPT as described below.

1.3.3.1 Geotechnical Borings

Geotechnical borings will be conducted within the Marine Terminal survey area and along the Pipeline survey area near potential shoreline crossings. Geotechnical borings will be conducted by collecting geotechnical samples from borings 15.2 to 70.0 m (50–200 ft) deep using a rotary drilling unit mounted on a small jack-up platform. Geotechnical borings provide geological information at greater sediment depths than vibracores. These data are required to help inform

Comment [CEJ1]: Add minimum impulse interval

Comment [CEJ2]: Equipment deployment depth

Comment [CEJ3]: Add minimum impulse interval

Comment [CEJ4]: Equipment deployment depth proper designs and construction techniques for pipeline crossing and terminal facilities. The number of and general locations for the planned geotechnical boreholes are provided in Table 3.

Table 3. Geotechnical borings planned for the Cook Inlet 2015 G&G Program[1].

Survey Area	Number of Borings	Boring Depth m (ft)	Diameter [1] cm (in)	Drilling Mud
Pipeline Survey Area	8	≤15.2 (≤50)	25.4 (10)	Secovis
Marine Terminal Boring Subarea	24	≤70.0 (≤200)	25.4 (10)	Secovis
	10	≤15.2 (≤50)	25.4 (10)	Secovis
All	42	NA	25.4 (10)	Secovis

[1] Diameter of the borehole

The jack-up platform is anticipated to be the Seacore *Skate 3* modular jack-up or a similar jack-up. The *Skate 3* modular platform is supported by four 76-cm (30-in) diameter legs. The borings will be drilled with a Comacchio MC-S conventional rotary geotechnical drill rig mounted on rubber skids. Four geotechnical boreholes will be drilled at each of the two shoreline crossings (eight total), and up to 34 boreholes will be drilled in the terminal boring area within the Marine Terminal survey area.

Sound source verifications of larger jack-up drilling rigs in Cook Inlet (*Spartan 151* and *Endeavour*) have shown that underwater sound generated by rotary drilling from elevated platforms on jack-ups generally does not exceed the underwater ambient sound levels at the source (MAI 2011, I&R 2014). Underwater sound generated by these larger drill rigs was identified as being associated with their large hotel generators or with underwater deep-well pumps, neither of which the *Skate 3* has. Sound source information is not available for the *Skate 3*, however the rubber tracks of the skid and the narrow legs of the rig greatly limit the transmission of sound (via vibrations) from the drilling table into the water column. The *Skate 3* is equipped with only a small deck-mounted pump and generator. Underwater sound generated from the *Skate 3* from geotechnical borings is not expected to exceed 120 dB re 1 μPa-m (rms) at source; the borings are therefore not further evaluated as a potential noise impact. The borings will affect benthic habitat as later described.

1.3.3.2 Shallow Geotechnical Investigations

Shallow geotechnical investigations include vibracores, sediment grab samples, and PCPT as described below. The planned numbers and general location of these investigations are indicated in Table 4.

Table 4. Planned shallow geotechnical sampling during Cook Inlet 2015 G&G Program.

Type	Pipeline Survey Areas			Terminal Survey Areas	Grand Total
	Location	Interval	Total	Total	
Vibracore	centerline	2.5 mi	22	33	55+
PCPT	centerline	5.0 mi	11	NA	11+
Grab	as needed[1]	1.0 mi	44	11	55+

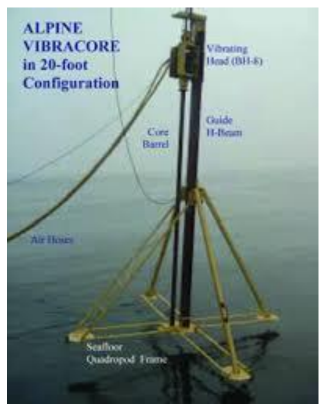
[1] Numbers and locations of shallow geotechnical sampling efforts off the pipeline route centerline will be determined in the field.
[2] These are planned efforts; additional vibracores, PCPT tests, and grab samples will be collected as warranted based on geophysical information in the field.

Estimates of seafloor area that might be directly disturbed from a vibracore, PCPT test, or grab sample, are provided in Table 5.

Table 5. Seafloor disturbance by shallow geotechnical sampling tools.

Equipment	Length cm (in)	Width cm (in)	Diameter cm (in)	Target Depth of Seafloor Penetration m (ft)
Vibracores	NA	NA	10.4 (4.0)	6.1 (20)
PCPT	NA	NA	5.1 (2.0)	4.9 (16)
Grab	35.6 (14)	27.9 (11)	NA	(0.3) 1

Vibracores



Vibracoring is conducted to obtain cores of the seafloor sediment from the surface down to a depth of about 6.1 m (20 ft). The cores are later analyzed in the laboratory for moisture, organic and carbonate content, shear strength, and grain size. Vibracore samplers consist of a 10.4-cm (4.0-in) diameter core barrel and a vibratory driving mechanism mounted on a four-legged frame, which is lowered to the seafloor. The driving mechanism oscillates the core barrel into the sediment where a core sample is then extracted. The duration of the operation varies with substrate type, but generally the sound source (driving mechanism) is operable for only the one or two minutes it takes to complete a 6.1-m (20-ft) bore, and the entire setup process often takes less than one hour. Only about three vibracorings per day are expected to be conducted over about 14 days of vibracoring activity.

Chorney et al. (2011) conducted sound measurements on an operating vibracorer in Alaska and found that it emitted a sound pressure level at 1-m source of 187.4 dB re 1 µPa-m (rms), with a frequency range of between 10 Hz and 20 kHz (Table 2). Vibracoring will result in the largest zone of influence (ZOI; area ensonified by sound energy greater than the 120 dB threshold) among the continuous sound sources. Vibracoring would also have a very small effect on the benthic habitat.

Vibracoring will be conducted at approximate intervals of one every 4.0 km (2.5 mi) along the centerline of the pipeline survey area total and at other locations in the pipeline vibracore area as warranted by geophysical survey results for a total of about 22 vibracores. Approximately 33 vibracores will also be collected within the Marine Terminal survey area.

Sediment Grab Samples

Grab sampling will involve using a 2 L Van Veen grab sampler that will be lowered with its “jaws” open to the seafloor from the geophysical vessel at which point the closing mechanism is activated, thus “grabbing” a sample of bottom sediment. The sampler is retrieved to the vessel deck and a sample of the sediments collected for environmental and geotechnical analysis, such as soil description and sieve analyses. Grab sampling does not produce significant underwater sound, but will have a small effect on the benthic habitat. Grab samples will be obtained at approximately 1.6-km (1-mi) intervals.

Piezo-cone Penetration Testing - PCPT

CPT involves placing a metal frame on the ocean bottom and then pushing an instrumented cone into the seafloor at a controlled rate, measuring the resistance and friction of the penetration. The results provide a measure of the geotechnical engineering property of the soil, including load-bearing capacity and stratigraphy. PCPT is planned for the Marine Terminal survey area and at ~8.0 km (5.0 mi) intervals along the proposed pipeline survey area centerline, but additional PCPT may be conducted anywhere in the Pipeline survey area as warranted by the geophysical survey results. The target depth is about 4.9 m (16 ft). Precise target locations shall be determined in the field and will be adjusted by onboard personnel after the preliminary geophysical data has been made available to allow for sample locations that better identify soil transition zones and/or other features. PCPT will have an inconsequential effect on benthic habitat.

1.3.4 Vessels

The geophysical surveys and vibracoring will be conducted from three source vessels (Table 6). Geotechnical borings will be conducted from a jack-up platform. The jack-up platform is not self-powered, and would be positioned over each sampling location by a tug.

The proposed numbers, types, and dimensions of vessels for this program are indicated in Table 6 below. The contracted vessels will be these vessels or similar vessels with similar configurations.

Table 6. Vessels expected to be used in the Cook Inlet 2015 G&G Program.

Activity	Vessel Type (number)	Example Vessel [2]	Length m (ft)	Width m (ft)	Horsepower
Geophysical surveys [1]	Source vessel	*Qualifier 105*	32.0 (105)	9.1 (30)	1,200
	Source vessel	*Westerly*	15.2 (50)	4.7 (15.5)	1,000
Vibracores	Source vessel	*Arctic Seal*	40.8 (134)	9.8 (32)	850
Geotechnical studies	Jack-up platform (1)	*Skate 3*	18.3 (60)	12.2 (40)	NA
	Tug (1)	*Cosmic Wind*	15.9 (52)	6.1 (20)	1,100

[1] Some shallow geotechnical activity (sediment grab sampling) may be conducted from geophysical source vessels
[2] May be these vessels or similar vessels

2.0 STATUS OF LISTED SPECIES

Three species of NMFS-jurisdiction marine mammals that are currently listed under the ESA regularly inhabit Cook Inlet (Table 7). These include the Cook Inlet stock of the beluga whale (*Delphinapterus leucas*), which largely inhabits upper Cook Inlet in the summer months and mid-inlet in the winter, and is the only listed species expected to be found in the Action Area. Humpback whales (*Megaptera novaeangliae*) and Steller sea lions (*Eumetopias jubatus*) occur in the lower reaches of lower Cook Inlet; the former only during the summer months. Records of these species in upper Cook Inlet are rare. They are not expected to be encountered within the Action Area during G&G operations. A fourth species, the northern sea otter (*Enhydra lutris kenyoni),* occurs on both eastern and western nearshore areas of lower Cook Inlet, but only the Southwest Alaska stock, occurring along the western shoreline, is currently listed (Allen and Angliss 2014). The northern extent of this listed stock is south of the any pipeline activity proposed to occur along the western shoreline of upper Cook Inlet (Allen and Angliss 2014). Further, sea otters fall under the jurisdiction of the U.S. Fish and Wildlife Service and, thus, are not addressed further in this BA.

Table 7. ESA-listed marine mammals inhabiting the Action Area.

Species	Stock Estimate [1]	Comment
Humpback Whale	7,469	Central North Pacific Stock
Beluga Whale	312	Cook Inlet Stock, ESA-listed as Endangered
Steller Sea Lion	45,649	Western U.S. Stock

[1] Source: Allen and Angliss (2014)

2.1 HUMPBACK WHALE (*MEGAPTERA NOVAEANGLIAE*)

2.1.1 ESA Status

The humpback whale was protected under international convention in 1966, although illegal whaling continued to occur well into the 1970s and possibly the 1980s (NMFS 1991). They were listed as endangered under the Endangered Species Conservation Act in 1969, and again under the ESA in 1973 (NMFS 1991), a designation that continues today. There is no designated critical habitat, but a recovery plan was finalized in 1991 (NMFS 1991). Rice (1974) estimated the North Pacific population prior to modern whaling at about 15,000 animals, and Tonnessen and Johnsen (1982) estimated that same number of whales were taken between 1919 and 1987. The 1966 population was estimated at 1,200 whales, or around 8 percent of the pre-exploitation population (Johnson and Wolman 1984).

2.1.2 Biological Status

2.1.2.1 Abundance and Trends

There are numerous population estimates for North Pacific humpback whales depending on the survey and modeling techniques. An intensive three-year (2004–2006) photo-identification study (SPLASH) was conducted in an attempt to determine the population structure and abundance of North Pacific humpback whale populations (Calambokidis et al. 2008). The results of the study provided a best estimate overall abundance of 18,302 for the entire North Pacific, or an estimate higher than the pre-exploitation population estimated by Rice (1974). Since protection in 1966, the North Pacific population has grown at an annual rate of about 6 to 7 percent (Caretta et al. 2013).

Although there is considerable distributional overlap in the humpback whale stocks that use Alaska, the whales seasonally found in lower Cook Inlet are probably of the central North Pacific stock, the largest of the three stocks comprising the North Pacific population, and the one that winters in Hawaii. Analysis of SPLASH data (Calambokidis et al. 2008, Barlow et al. 2011) provided an estimate for the central North Pacific stock of between 7,469 and 10,103, with the portion that feeds in the Gulf of Alaska (including lower Cook Inlet) estimated at 2,845 animals (Allen and Angliss 2014).

2.1.2.2 Distribution and Habitat Use

Three stocks of humpback whale inhabit Alaska. The California/Oregon/Washington stock winters in the nearshore waters off Mexico and Central America, and summers off California, Oregon, and Washington. The central North Pacific stock winters in Hawaiian waters and migrates to summer feed in the coastal waters of British Columbia, Southeast Alaska, the Gulf of Alaska, the eastern Bering Sea, and the Aleutian Islands. The Western North Pacific stock winters off the coast of Asia and primarily summers in Russian waters, although it overlaps with the summer distribution of the central North Pacific stock in the Bering Sea and along the Aleutians. Based on genetic analysis and movements of known animals (Calambokidis et al. 2008), there appears to be little annual interchange between these three stocks. Only whales from the central North Pacific stock likely summer in lower Cook Inlet.

Humpback whales are coastal in their habitat use, generally found summering in shelf edge, shelf, and inland waters where marine productivity is high due to upwelling or converging currents (Brodie et al. 1978, NMFS 1991). In Alaska, these whales are found both in shelf edge and inland waters. Cows with calves, in particular, are found in more sheltered waters. The central North Pacific stock winters along the shelf waters of the Hawaiian Islands where they mate and calve in the warmer waters.

2.1.2.3 Feeding and Prey Selection

For the most part, humpback whales prey on krill and schooling fish with the composition dependent on the feeding location. In the waters of central Alaska, Pacific herring (*Clupea harengus pallasi*) and krill (*Euphausia* spp., *Thysanoessa* spp.) are the most important prey items (see Frost and Lowry 1981, Krieger and Wing 1984). Nemoto (1957) found stomachs of humpbacks taken during Japanese whaling in the North Pacific to contain almost entirely euphausiids.

2.1.2.4 Reproduction

Humpback whale calving and breeding occurs on the warmer-watered wintering grounds. The high population growth rate (average annual rate of 6–7 percent) since the 1960s is partially explained by a higher reproduction rate compared to other large whales. Females sexually mature at 4 to 6 years of age and gestation periods are less than 12 months (NMFS 1991). The calving interval is generally two to three years, but some whales have calved in consecutive years (NMFS 1991).

2.1.2.5 Natural Mortality

Identified natural mortality in the North Pacific has been limited to occasional killer whale (*Orcinus orca*) predation, although red tide events and possibly parasite overload has been implicated in deaths of North Atlantic humpback whales. Killer whales have been observed killing humpbacks in Southeast Alaska (Dolphin 1987), and the rake marks on whale flukes have been attributed to killer whale attacks, although there is speculation that some marks are due to attacks on juveniles by false killer whales (*Pseudorca crassidens*) on Hawaiian wintering grounds (NMFS 1991).

2.1.3 Species Use of the Action Area

Humpback use of Cook Inlet is largely confined to lower Cook Inlet. They have been regularly seen near Kachemak Bay during the summer months (Rugh et al. 2005a,b), and there is a whale-watching venture in Homer that features this seasonal event. A few whales have been observed a few miles north of Anchor Point. During marine mammal monitoring efforts conducted at an offshore drilling site approximately 4.8 km (3 mi) offshore of Cape Starichkof and approximately 10 km (6.2 mi) north of Anchor Point in 2013 (Owl Ridge 2014), observers recorded 29 sightings of 48 humpback whales. Most of these animals were observed at a distance well south of the well site, and many records were repeat sightings of the same animals. Nevertheless, the observations confirm that the regular Cook Inlet distribution of humpback whales extends to about Cape Starichkof. Still, the most northern of these records are at least 90 km (56 mi) south of Nikiski (the proposed Marine Terminal location). There have been anecdotal reports of humpbacks in upper Cook Inlet, but these have not been regular events.

2.2 BELUGA WHALE (*DELPHINAPTERUS LEUCAS*)

2.2.1 ESA Status

The isolated Cook Inlet Stock of the beluga whale was listed under ESA as endangered in 2008 (73 FR 62919) after declining from about 1,300 animals in 1979 (Calkins 1989) to an estimated 278 animals in 2005 (Allen and Angliss 2014). Unusually high subsistence harvest best explains the observed decline as approximately 10 to 15 percent of the stock was removed annually between 1994 and 1998 (Mahoney and Shelden 2000). A conservation plan was finalized in 2008 (NMFS 2008a) and critical habitat was designated in 2011 (76 FR 20180) (Figure 2). A draft recovery plan has been prepared by the Cook Inlet Beluga Recovery Team, and includes the measurable criteria that when met, would result in the determination that Cook Inlet beluga whales may be removed from ESA listing. NMFS expects to publish the draft plan for public review and comment later in 2015.

2.2.2 Biological Status

The Cook Inlet beluga whale stock is a small geographically isolated population that is separated from other beluga populations by the Alaska Peninsula. The population is genetically (mtDNA) distinct from other Alaska populations suggesting the Peninsula is an effective barrier to genetic exchange (O'Corry-Crowe et al. 1997) and that these whales may have been separated from other stocks at least since the last ice age. Laidre et al. (2000) examined data from more than 20 marine mammal surveys conducted in the northern Gulf of Alaska and found that sightings of belugas outside Cook Inlet were exceedingly rare, and these were composed of a few stragglers from the Cook Inlet DPS observed at Kodiak Island, Prince William Sound, and Yakutat Bay. Several marine mammal surveys specific to Cook Inlet (Laidre et al. 2000, Speckman and Piatt 2000), including those that concentrated on beluga whales (Rugh et al. 2000, 2005a), clearly indicate that this stock largely confines itself to Cook Inlet. There is no indication that these whales make forays into the Bering Sea where they might intermix with other Alaskan stocks.

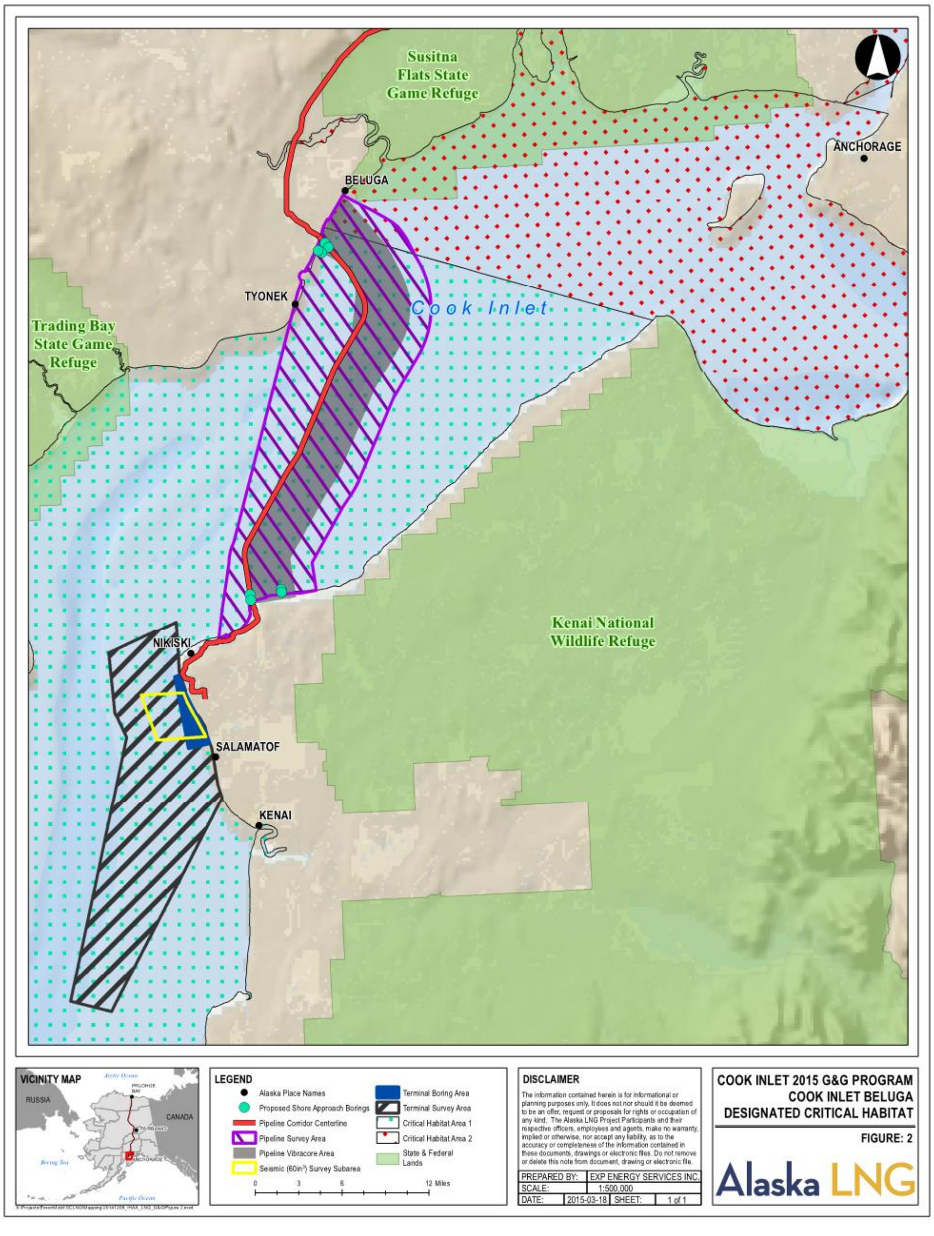
2.2.2.1 Abundance and Trends

The Cook Inlet stock was estimated at 1,300 whales in 1979 (Calkins 1989) and has been the focus of management concerns since experiencing a dramatic decline in the 1990s. Between 1994 and 1998 the stock declined 47 percent, which was attributed to overharvesting by Anchorage-based subsistence hunting (Mahoney and Shelden 2000). Subsistence hunting was estimated to then have annually removed 10 to 15 percent (or more) of the population. Only five belugas have been harvested since 1999, yet the population has continued to decline at a rate of about 1.3 percent annually, with the most recent estimate at only 340 animals (Sheldon et al. 2015).

2.2.2.2 Distribution and Habitat Use

Prior to the decline, this stock was believed to range throughout Cook Inlet and occasionally into Prince William Sound and Yakutat (Nemeth et al. 2007). However the range has contracted coincident with the population reduction (Speckman and Piatt 2000, Rugh et al. 2010). During summer and fall, beluga whales are concentrated near the Susitna River mouth, Knik Arm, Turnagain Arm, and Chickaloon Bay (Nemeth et al. 2007). Critical Habitat Area 1 reflects this summer distribution (Figure 2). During winter, beluga whales concentrate in deeper waters in the mid-inlet to Kalgin Island, and in shallow water along the west shore of Cook Inlet to Kamishak Bay (Critical Habitat Area 2; Figure 2). Some whales have wintered in and near Kachemak Bay.

Figure 2. Cook Inlet beluga whale designated critical habitat



2.2.2.3 Feeding and Prey Selection

In the late spring and summer, Cook Inlet belugas concentrate in river mouths of upper Cook Inlet where they feed upon seasonal runs of eulachon (*Thaleichthys pacificus*) (Hobbs et al. 2006) and salmon (*Onchorhynchus* spp.) (Moore et al. 2000). During the remainder of the year they feed mostly on cod, sculpins, and flounders (NMFS 2008a).

2.2.2.4 Reproduction

Belugas become sexually mature at between 8 and 13 years of age (Burns and Seaman 1986). Gestation is 14 to 14.5 months (NMFS 2008a), and calving interval is two to three years (Sergeant 1973). Pregnancy rates are highest for the 12–21-year age class (Burns and Seaman 1986). Published annual reproductive rates (proportion of the population that are calves) have ranged between 0.08 and 0.14 (NMFS 2008a). In Cook Inlet, most calving is thought to occur from mid-May to July (Calkins 1983).

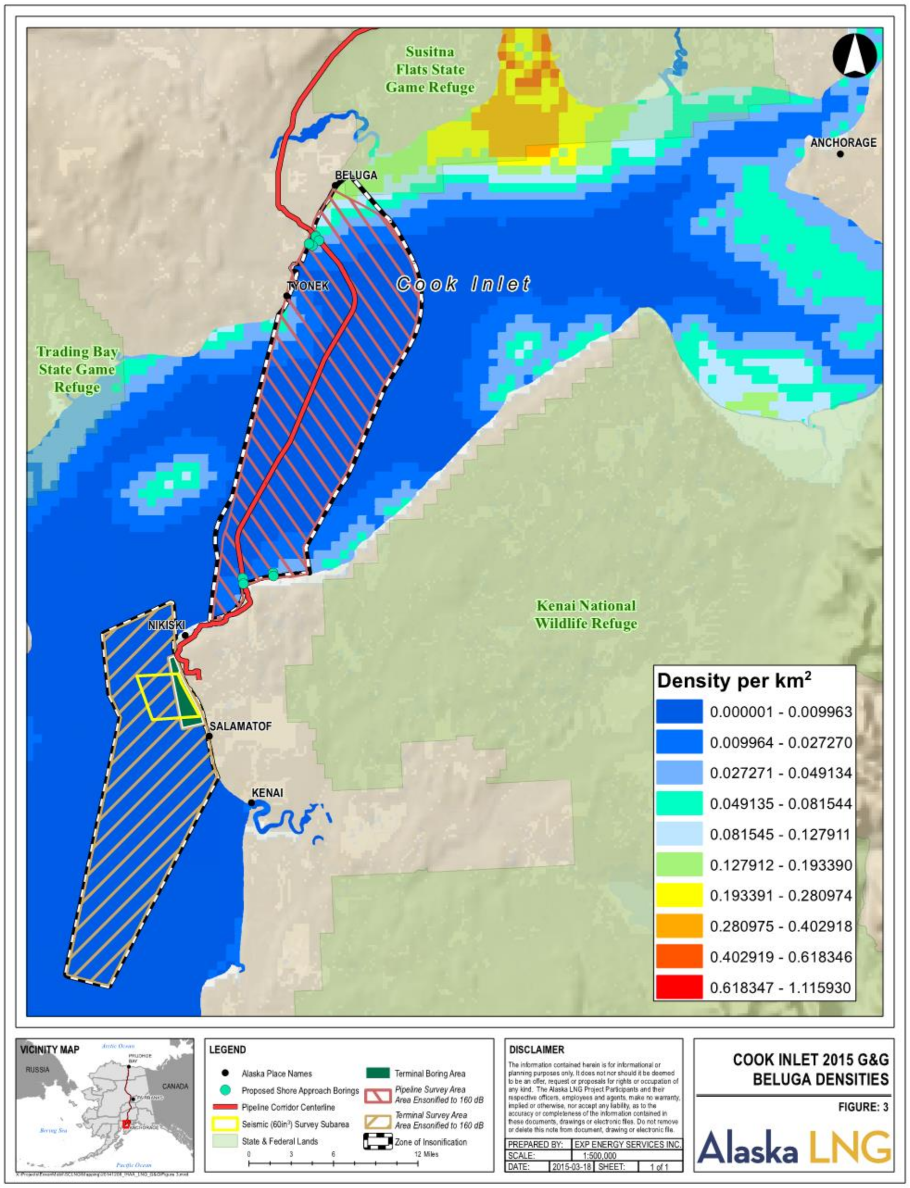
2.2.2.5 Natural Mortality

Natural mortality includes stranding due to entrapment in shallow water from receding tides, and killer whale predation. However, most tidal strandings do not involve mortalities (Allen and Angliss 2014), and only four killer whale predation events were recorded between 1999 and 2008 (Sheldon et al. 2003, Vos and Shelden 2005, Hobbs and Shelden 2008), and not all attacks were fatal.

2.2.3 Species Use of the Action Area

Goetz et al. (2012) modeled beluga use in Cook Inlet based on the NMFS aerial surveys conducted between 1994 and 2008. The combined model results shown in Figure 3 indicate a very clumped distribution of summering beluga whales, and that lower densities of belugas are expected to occur within the Pipeline survey area and the vicinity of the proposed Marine Terminal. The area between Nikiski, Kenai, and offshore to Kalgin Island provides important wintering habitat for Cook Inlet beluga whales. Use of this area would be expected between late fall and spring, with animals largely absent during the summer and early fall months when G&G surveys would occur (Goetz et al. 2012).

Figure 3. Maximum ensonified areas / ZOIs associated with the Pipeline and Marine Terminal survey areas relative to beluga density contours from Goetz et al. (2012).



2.3 STELLER SEA LION (*EUMETOPIAS JUBATUS*)

2.3.1 ESA Status

Due to substantial population declines in the western portion of its range, the Steller sea lion was first listed as threatened under the ESA in 1990, with critical habitat designated in 1993 (NMFS 2008a). In 1997, NMFS identified two U.S. stocks, a western and an eastern, and reclassified the western U.S. stock as endangered based on persisting decline (NMFS 2008a). The western U.S. stock is defined as all populations west of longitude 144°W to the western end of the Aleutian Islands. The western U.S. stock declined more than 80 percent between the late 1960s and 2000 at consistently monitored rookeries and haulout sites. Critical habitat was designated in 1993, and includes a 20-nautical-mile buffer around all major haulouts and rookeries, and three large offshore foraging areas within the area used by the western U.S. stock. A recovery plan was developed in 2008 (NMFS 2008a).

2.3.2 Biological Status

The 20-nautical-mile buffer was established based on telemetry data that indicated these sea lions concentrated their summer foraging effort within this distance of rookeries and haulouts. Most of Cook Inlet may not provide adequate foraging conditions for sea lions to establish a major haulout presence (see Section 2.3.2.3).

2.3.2.1 Abundance and Trends

The minimum abundance estimate for the western U.S. stock of Steller sea lion, including Russian populations, is 45,916 animals based on pup and other count data collected between 2008 and 2011 (DeMaster 2011). This is down from a 1950s population estimated for Alaska alone at 140,000 (Merrick et al. 1987). This stock has grown at a slight 1.5 percent per year since 2000. (In contrast, the eastern U.S. stock increased at a 3 percent annual rate between the 1970s and 2002.)

2.3.2.2 Distribution and Habitat Use

Steller sea lions are found in all Continental Shelf waters from central California, north to Alaska, through the Aleutian Islands to Kamchatka Peninsula, then south to northern Japan. During summer Steller sea lions feed mostly over the continental shelf and shelf edge. Females attending pups forage within 20 nautical miles of breeding rookeries (Merrick and Loughlin 1997), which is the basis for designated critical habitat around rookeries and major haulout sites. During winter some of these sea lions may venture far out to sea in pursuit of prey (NMFS 2008b).

Steller sea lions inhabit lower Cook Inlet, especially in the vicinity of Shaw Island and Elizabeth Island (Nagahut Rocks) haulout sites (Rugh et al. 2005a), but are rarely seen in upper Cook Inlet (Nemeth et al. 2007). Of the 42 Steller sea lion groups recorded during Cook Inlet aerial surveys between 1993 and 2004, none were recorded north of Anchor Point and only one in the vicinity of Kachemak Bay (Rugh et al. 2005a). Marine mammal observers associated with Buccaneer's drilling project off Cape Starichkof (about 10 km {6.2 mi} north of Anchor Point) did observe seven Steller sea lions during the summer of 2013 and according to subsistence harvest records, they have been rarely taken by Native hunters as far north as Kenai (Wolfe et al. 2009). There are five opportunistic sightings from upper Cook Inlet in the NMFS database going back to 2003. In addition, four Steller sea lions were reported during Apache Corporation's seismic surveys within Trading Bay in 2012 (Lomac-MacNair et al. 2013), and one during monitoring associated with the Port of Anchorage's Marine Terminal Redevelopment Project in 2008 (ICRC 2009). These are the only recent records of these sea lions in upper Cook Inlet.

2.3.2.3 Feeding and Prey Selection

Steller sea lions feed on a wide variety of fish and cephalopods (Calkins and Goodwin 1988). In Alaska and British Columbia, schooling fish such as Pacific cod (*Gadus macrocephalus*), Pacific hake (*Merluccius productus*), walleye pollock (*Theragra chalcogramma*), Pacific herring, Pacific sand lance (*Ammodytes hexapterus*), squid, and salmon are of great importance, although rockfish (*Sebastes* spp.) are also important (Calkins and Goodwin 1988, Calkins 1998). Small schooling fish and salmon are eaten almost exclusively during summer, cod during winter, and pollock year-round (Merrick and Calkins 1996, NMFS 2008b).

The 20-nautical-mile buffer was established based on telemetry data that indicated these sea lions concentrated their summer foraging effort within this distance of rookeries and haulouts. Most of Cook Inlet may not provide adequate foraging conditions for sea lions for establishing a major haulout presence. Except for salmon, none of the prey species mentioned above are found in abundance in Cook Inlet (Nemeth et al. 2007).

2.3.2.4 Reproduction

Female Steller sea lions reach sexual maturity at 3 to 6 years of age and can continue to breed into their early 20s (Mathisen et al. 1962, Pitcher and Calkins 1981). Males are sexually mature at 3 to 7 years of age, but are not physically mature enough to challenge for breeding rights until about 10 years of age (Thorsteinson and Lensink 1962, Pitcher and Calkins 1981, Raum-Suryan et al. 2002). Sexually mature females are capable of pupping annually, and studies in the 1970s and 1980s found early gestation pregnancy rates of 97 percent (NMFS 2008b). However, during periods consistent with nutritional stress, pregnancy will be terminated early (intrauterine mortality or premature birthing) (Calkins and Goodwin 1988). During the decline of the western U.S. stock in the 1970s and 1980s, pregnancy rates during late-term gestation dropped to between 55 to 67 percent (NMFS 2008b), and for lactating females, the late-term pregnancy rate was even lower suggesting that nursing compounds the energetic stress of reproduction during periods of low food availability. Females with better body conditions were more likely to maintain pregnancy (NMFS 2008b).

2.3.2.5 Natural Mortality

About 20 percent of a stable Steller sea lion population dies annually from natural mortality including trampling, disease, senescence, and killer whale predation (NMFS 2008b). Killer whales have been implicated as a possible factor for the observed sea lion decline, or at least as a limit to recovery. Williams et al. (2004) explained that the foraging demands of even a relatively few killer whales could account for high sea lion losses. However, other studies have shown that sea lions are a relatively small component of the diet of mammal-eating killer whales for the western U.S. stock (6–22 percent; Wade et al. 2007), and that killer whales using Kenai Fjords annually ate from 3 to 7 percent of the local sea lion population, or only about a quarter of the annual natural mortality (Maniscalco et al. 2007). A decline in the carrying capacity resulting in nutritional stress and lower reproduction rates remains the most viable explanation for the dramatic decline of the western U.S. stock from the 1970s to 2000s (NMFS 2008b).

2.3.3 Species Use of the Action Area

As mentioned above, Steller sea lions rarely occur in upper and mid-Cook Inlet. Occurrence within the proposed G&G Action Area is possible, but not expected.

3.0 ENVIRONMENTAL BASELINE

3.1 STATUS OF THE SPECIES/CRITICAL HABITAT WITHIN THE ACTION AREA

3.1.1 Humpback Whale

The central North Pacific stock of the humpback whale has continued to increase over the past few decades, and may now exceed its original numbers (Calambokidis et al. 2008). However, critical habitat has not been designated for humpback whales, and their potential occurrence in the Action Area would be considered exceedingly rare.

3.1.2 Beluga Whale

Since protection from subsistence hunting in 1999, there is no evidence yet of the Cook Inlet beluga whale population beginning to recover towards previous numbers, and their summer range appears to have become more constricted to the Susitna Delta (Rugh et al. 2010). For unknown reasons, the population has continued to decline at -1.3%/year since 1999, although the trend over the past 10 years, while still declining (-0.4%/year; Shelden et al. 2015), has become more gradual. The most recent (2014) abundance estimate (340) does show a slight, but statistically insignificant, increase over the last two previous estimates (2011 and 2012). Significant numbers of summering beluga whales are not expected to occur within the Action Area during G&G operations.

3.1.3 Steller Sea Lion

Overall, the abundance of the western U.S. stock of Steller sea lions is increasing despite some localized areas of decline. However, the proposed project is located well outside Steller sea lion critical habitat, there are no recognized haulouts or rookeries in the Action Area, and Steller sea lions are rarely observed.

3.2 FACTORS AFFECTING SPECIES ENVIRONMENT WITHIN THE ACTION AREA

Cook Inlet beluga whales, and to a small degree humpback whales and Steller sea lions, may be affected by various manmade and natural factors present in upper and mid-Cook Inlet. Over 61 percent of the entire Alaskan human population (735,601) resides within southcentral Alaska or the Cook Inlet region. The Alaska Department of Labor and Workforce Development (2014) estimates the 2014 population for the Municipality of Anchorage alone was 300,950, while the Matanuska-Susitna Borough was 98,063 and Kenai Peninsula Borough was 57,212 (State DOLWD). The high degree of human activity, especially within upper Cook Inlet, has produced a number of anthropogenic risk factors including: coastal development, ship strikes, noise pollution, water pollution, prey reduction, direct mortalities, and research that listed marine mammals must contend with along with natural factors such as environmental change. These threats may occur individually or collectively (NMFS 2008a), and may affect critical habitat as well. These factors are discussed individually below.

3.2.1 Coastal Development

Beluga whales and Steller sea lions in particular use nearshore environments to rest, feed, and breed and, thus, could be affected by any coastal development that impacts these activities. For the most part, the Cook Inlet shoreline is undeveloped, but there are a number of port facilities, airports, housing developments, wastewater treatment plants, roads, and railroads that occur along or close to the shoreline, and there are several onshore and offshore oil and gas development facilities within Cook Inlet.

3.2.1.1 Port Facilities

Port facilities in Cook Inlet with in-water structures are found at Anchorage, Point Mackenzie, Nikiski, Kenai, Homer, Seldovia, and Port Graham, while barge landings are found at Tyonek, Drift River, and Anchor Point.

The Port of Anchorage (POA) is Alaska's largest seaport and provides 90 percent of the consumer goods for about 85 percent of all of Alaska. It includes three cargo terminals, two petroleum terminals, one dry barge berth, two railway spurs, and a small craft floating dock, plus 220 acres of land facility. About 450 ships or tug/barges call at the POA each year. The POA began an expansion project in 2006, the POA Intermodal Expansion Project, but parts of the project stalled in 2011 due to construction problems with sheet pile placement. The project is expected to resume in 2016 and be completed by 2022. When ultimately completed, the project will rebuild aging infrastructure and provide additional space for cargo handling.

During the project's sheet pile driving activities conducted between 2009 and 2011, the POA acoustically harassed 40 Cook Inlet beluga whales, ranging from a high of 23 in 2009 and a low of 4 in 2011. The POA was authorized by NMFS to harass 34 annually. A single Steller sea lion was sighted at the facility in 2009, and take of this animal was ostensibly avoided by shutting down the pile driving activity.

Additionally, dredging is conducted annually under the direction of the U.S. Army Corps of Engineers (2013) to maintain a water depth of 35 feet at the POA terminals. In 2013, about 2.8 million cubic yards of material was removed in about 35 days. The existing permit allows maintenance dredging to occur through 2017, and it is assumed that dredging activity will occur in 2015. The effect of this dredging activity on Cook Inlet belugas is unknown; however, the re-suspension of sediments and entrained contaminants in the water column due to dredging was considered a threat to St. Lawrence beluga whales (DFO 2012). This threat is probably less likely in Cook Inlet because of a lack of contamination history compared to the St. Lawrence River, and Cook Inlet belugas are already adapted to water heavily laden with silt from glacial runoff.

Port MacKenzie is located on the western shore of Knik Arm about 5 km (3.1 mi) northwest of Point MacKenzie. The port is owned and operated by the Matanuska-Susitna Borough, and includes both a deep-draft dock and a barge dock. Knik Arm is seasonally important to beluga whales during late summer salmon runs heading up the Knik River (Rodrigues et al. 2006). Operations at Port MacKenzie include dry bulk cargo movement and storage. WesPac is developing Liquefied Natural Gas (LNG) facilities in several parts of the nation, and plans to build a small or mid-sized LNG facility at Port MacKenzie on upper Cook Inlet for distribution to Alaskan communities. Facilities will be built on the uplands and no dock expansions are anticipated in the near future, however an increase in vessel traffic will likely be an impact when operations begin in 2017.

The Drift River facility in Redoubt Bay is used primarily as a loading platform for shipments of crude oil. The docking facility there is connected to a shoreside tank farm and designed to accommodate tankers in the 150,000 deadweight-ton class. In 2009, a volcanic eruption forced the evacuation of the terminal and an eventual draw-down of oil storage. Hilcorp Alaska bought the facility in 2012 and after numerous improvements partially reopened the facility to oil storage and tanker loading operations. The Trans-Foreland pipeline, when constructed, is meant to eliminate some of the need for oil storage at this terminal.

Nikiski is home to several privately owned docks (including those belonging to oil and gas companies). Activity at Nikiski includes the shipping and receiving of anhydrous ammonia, dry bulk urea, LNG, petroleum products, sulfuric acid, caustic soda, and crude oil. In 2014, the Arctic Slope Regional Corporation expanded and updated its dock in Nikiski, referred to as the Rig

Tenders Dock, in anticipation of increased oil and gas activity in Cook Inlet and to serve activities in the Chukchi and Beaufort seas.

Ladd Landing beach, located on the Western Cook Inlet near Tyonek, serves as public access to the Three Mile Subdivision, and as a staging area for various commercial fishing sites in the area. Numerous development projects are proposing development in this area that will include a facility for cargo loading. PacRim's current plans are to build a conveyor to transport the coal from a mine service area to the Ladd Coal Export Terminal located within the Ladd Landing Development. The coal conveyor would transfer 15 to 18 million tons of coal per year. Project impacts to beluga whales are not known at this time, though the applicant proposes that any construction would avoid beluga spring migration. PacRim's recent application identified there would be coal dust control at the storage and transfer areas but details on the controls are not known at this time. Donlin Gold (2012) also had plans for expanding the barge landing at Beluga and developing a temporary construction camp and staging areas. The "Beluga Barge Landing" is south of the Three Mile Subdivision near the proposed location for the Chuitna Mine cargo loading facility. Donlin Gold is engaged in the NEPA process and will not begin construction until all permits are issued. No in-water work will occur during the summer of 2015; however, potential impacts to beluga whales will result from increased vessel traffic and construction activities when the project is approved.

3.2.1.2 Other Coastal Development

The City of Kenai proposes to discharge 4,282 cubic meters (5,600 cubic yards) of gravel fill into 0.55 ha (1.35 ac) of estuarine intertidal emergent wetlands to facilitate the construction of an access road from Sea Catch Drive to South Beach near the confluence of the Kenai River. The proposed road would serve as access to the mouth of the Kenai River in support of a personal use salmon dipnet fishery that occurs annually and will be open to beach access for other user groups. The new road will eliminate vehicle traffic on the intertidal shoreline. Construction activities are proposed to occur during the summer of 2015.

Numerous tidal energy projects have been proposed in Cook Inlet. The state has issued a lease for the East Foreland tidal demonstration project near Nikiski proposed by Ocean Renewable Power Company, LLC (ORPC). ORPC (2014) collected baseline data to characterize pre-deployment patterns of marine mammal distribution, relative abundance, and behavior in the deployment area at East Foreland and at Fire Island. Baseline data was obtained from passive acoustic monitoring devices and by visual observations, which are now complete. Upon the recommendation of NMFS, the pilot demonstration project is projected to be installed at East Forelands in 2016 or 2017 instead of the Fire Island location. Also, in 2014, FERC granted a permit to Turnagain Arm Tidal Energy Corp for a continued feasibility study to develop a 240 megawatt (MW) Alaska tidal energy project. The project would consist of a 12.9-km (eight-mile) long tidal fence located between Fire Island and Point Possession.

3.2.1.3 Oil and Gas Exploration and Development Activities

State lease sales for oil and gas development in Cook Inlet began in 1959 (ADNR 2014). Since then, the state has held 56 oil and gas lease sales in the Cook Inlet area. As of December 31, 2013, approximately 450,000 ha (1.1 million ac) were under lease in the Cook Inlet sale area, which includes 173,563 ha (428,884 ac) onshore and 281,885 ha (696,552 ac) offshore (ADNR 2015). The most recent lease sale in May 2014 resulted in an additional 43,885 ha (108,443 ac) leased but exploration and development from the recent sale is not expected to occur in 2015.

Oil and gas exploration and development activities routinely occur within the proposed Action Area in Cook Inlet. Much of the Cook Inlet region overlies reserves of oil and natural gas. Upper Cook Inlet and the Kenai Peninsula have an association with the petroleum industry that dates back to the 1950s. Until recently, oil and gas production and royalties were on a slow decline;

however; investment in existing infrastructure and reconstructed unit operations has resulted in increasing oil and gas development.

There are 16 offshore oil and gas platforms in Cook Inlet, 14 of which were installed between 1964 and 1968, the others in 1986 and 2000. Twelve platforms are actively producing oil and gas and four are experiencing varying degrees of inactivity. There are no platforms in the lower Inlet. However, BlueCrest Energy will be partnering with California-based WesPac to develop natural gas resources in the Cosmopolitan State oil and gas prospect from an offshore location in 2016 and 2017. Planned work during 2015 includes installation of a water intake structure and additional exploratory drilling at the well site.

Hilcorp is conducting field studies at the Ivan River Unit and North and South Middle Ground Shoal Unit to consider reactivating the Dillon Platform. Additionally, Hilcorp was successful in obtaining new leases in the middle shoal area during 2014 lease sales. It is not expected that they will conduct any in-water work during 2015, however, it is possible that there will be additional vessel or air traffic in support of these studies. Impacts to beluga whales would be minimal and likely consist of additional background marine and air traffic.

In the 2014, Furie Operating Alaska, LLC, applied for approvals to develop and transport natural gas from the Kitchen Lights Unit (KLU) located approximately 16 km (10 mi) northwest of Boulder Point, near Nikiski. The development wells will be drilled from a jack-up rig over the fixed platform. Well tubulars will pass through a caisson that will be fixed to the seafloor by piles driven 36.6 m (120 ft) into the seabed. Furie has received approvals from state and federal agencies and the Kenai Peninsula Borough. The platform (KLU Platform A) was constructed in Corpus Christi, Texas, and will be shipped to Alaska early in 2015. The impact to belugas would be noise from vessel operations moving the jack-up rig to the project area, noise from pile driving operations, and installation of the gathering pipelines.

BlueCrest Energy Inc. has been given the approval to begin the development of the Cosmopolitan oil development project located approximately 9.7 km (6 mi) north of Anchor Point on the Kenai Peninsula. BlueCrest proposes to drill one exploratory well at Cosmopolitan State #B-1 site during the 2015 open-water season, which is typically from April through October. Associated activities identified in their IHA that could result in a take of marine mammals include pipe driving, exploratory drilling, towing of the jack-up drill rig, and vertical seismic profiling (VSP). BlueCrest also intends to begin construction of the onshore development facilities, which includes the installation of a subsea seawater intake structure that will utilize up to 1.59 million L (420,000 gal) per day of sea water to maintain pressure in the oil formation. The Alaska Department of Environmental Conservation (ADEC) permit schedule identifies that the individual permit for wastewater treatment and disposal will not be processed until 2016, however some associated in-water work could be conducted in 2015.

SAE Exploration is planning to conduct up to 777 km^2 (300 mi^2) of 3-D seismic survey in Cook Inlet in 2015, which likely includes Apache's multi-year seismic exploration in Cook Inlet. The Alaska Department of Natural Resources (ADNR 2015) notes that since December 31, 2013, approximately 3,367 km^2 (1,300 mi^2) of 3-D and 40,000 km (25,000 mi) of 2-D seismic line surveys have been conducted in Cook Inlet.

3.2.1.4 Underwater Transmission Lines and Pipelines and other Underwater Installations

Currently in Cook Inlet there are approximately 365 km (227 mi) of undersea pipelines, which includes 125 km (78 mi) of oil pipelines and 240 km (149 mi) of gas pipelines (ADNR 2015).

In 2014, the Trans-Foreland Pipeline Co. LLC (owned by Tesoro Alaska) received approval from state, federal, and regional agencies to build a 46.7-km (29-mi) long, 20.3-cm (8-in) oil pipeline (Trans-Foreland Pipeline) from the west side of Cook Inlet to Tesoro refinery at Nikiski. The pipeline will be used by multiple oil producers in western Cook Inlet, to replace oil transport by tanker from the Drift River Tank farm. The purpose of the Trans-Foreland Pipeline project is to transport oil across Cook Inlet originating at the Cook Inlet Energy Kustatan Production Facility to the Nikiski-Kenai Pipeline company tank farm on the east side of Cook Inlet. The pipeline will be buried in uplands and tidelands and anchored onto the seafloor across the inlet. Construction is expected to begin in 2015. Subsea pipeline installation will begin in May and be completed by the end of September but most in-water work will be completed by June. A pipeline laying barge will be used for pipe welding and installation. Where possible, the pipeline may be buried using a subsea trenching jet sled that uses a high-pressure water jet to open a trench in the seabed underneath the pipeline after it has been laid on the seafloor. Horizontal directional drilling (HDD) will be used to install the pipeline at nearshore locations at the East and West Forelands. The ADEC issued a wastewater discharge authorization in 2014 under a general permit for hydrostatic testing water. HDD drilling muds and cuttings are to be recovered and disposed of at existing grind and inject facilities at Kustatan and Nikiski. It is expected that some siltation will occur during pipeline laying operations. Any impact from reduced visibility would be short term due to the high tide velocities.

Impacts to listed marine mammals can occur from underwater noise associated with underwater pipeline construction, including noise from the use of pipe laying barges, tugs, and support vessels, although NMFS does not regulate sound associated with maritime traffic and general vessel operation). Tug boats will position the lay barge and its anchor array. The subsea trenching jet sled used during construction operates with high-pressure water jets. No motors or compressors are located on the underwater jet sled. Hydraulic hoses, located on the deck of the barge, are connected to a gear box and underwater installation frame. Hydraulics are used to turn the anchor during installation. No motors or compressors are located in the water, thus underwater the sound levels are expected to be lower than 120 dB. All noise associated with pipeline construction will be short term and localized. Few, if any, beluga whales are expected to be in the area during the in-water construction window.

As previously mentioned, Furie Operating Alaska LLC has been issued a right-of-way (ROW) lease to install a platform and two gathering lines in the Kitchen Lights Unit.

There are numerous communication cables lying on the bottom of Cook Inlet on the seafloor. While some of the cables are buried, there are locations that the cables lie on top of the seafloor and are weighted down. Existing fiber optic cable leases within the project area include the Kodiak-Kenai Cable Company fiber optic cable that runs a cable on the east side of Cook Inlet from Homer to Anchorage. Cook Inlet Energy has an approved fiber optic ROW that generally follows the Trans-Foreland pipeline route between Kustatan and Nikiski. Alaska Communications Systems Group, Inc. (ACS) installed a fiber optic cable in 2009 on the east side of Cook Inlet from Homer to Nikiski on the Kenai Peninsula to Point Woronzof in Anchorage. While these cables are already installed, maintenance activities can be expected to occur at any time when damaged. Repair operations include vessel deployment and diving crews. Potential impacts from fiber optic cable maintenance include a temporary increase in vessel traffic and noise during cable repairs.

3.2.2 Ambient/Background Noise and Noise Pollution

Marine mammals rely heavily on sound to meet basic biological needs such as communicating, foraging, and navigating (Richardson 1995), especially in the turbid waters of Cook Inlet. In general, Cook Inlet is a noisy environment and noise has the potential to disrupt beluga whales' ability to meet these basic biological needs. Noise sources in Cook Inlet that could be found in the Action Area include ambient sound (e.g., flow noise, wind), large and small vessels, aircraft, oil and gas exploration and production, and construction activities (e.g., dredging and pile driving; NMFS 2008a).

3.2.2.1 Ambient and Background Noise

Ambient noise is environmental background noise that includes sources such as wind, waves, ice, current, and tidal flow, and biological factors such as shrimp (Richardson 1995). Background noise includes anthropogenic noise factors that cannot be identified to a single source. Sound levels from ambient noise vary at different locations in Cook Inlet.

Blackwell and Greene (2002) reported ambient levels, devoid of industrial sounds, at Birchwood of approximately 95 dB, to over 120 dB for locations off Elmendorf Air Force Base and north of Point Possession. At the mouth of Eagle River, they reported ambient levels of approximately 107.2 dB re 1 µPa. Blackwell (2005) reported background levels, not devoid of industrial sounds, without strong currents of 115 to 118 dB. Scientific Fishery Systems, Inc. (2009) indicated background levels at the Port of Anchorage ranged from 120 to 155 dB, depending heavily on wind speed and tide level. All of these studies indicate measured background levels are rarely below 125 dB, except in conditions of no wind and slack tide. However, all these studies were conducted in upper Cook Inlet where tidal bores associated with Turnagain Arm and Knik Arm occur. Farther south in Trading Bay, Illingworth & Rodkin (see Apache LOA Application 2014) found background noise levels at between only 90 and 100 dB. However, Illingworth & Rodkin (2014) also measured background noise associated with drilling activity in lower Cook Inlet (Cape Starichkof) and found background levels between 105 and 118 dB.

In general, ambient and background noise levels within the Action Area are assumed to be less than 120 dB whenever conditions are calm, and exceeding 120 dB during storm events and during passage of large vessels.

3.2.2.2 Oil and Gas Exploration and Production Noise

Cook Inlet has a long history of oil and gas activities including seismic exploration, geophysical and geotechnical (G&G) surveys, exploratory drilling, drilling fleet operation, and platform production operation. These activities potentially produce noise that could harass marine mammals, although oil and gas activities have not been identified as specific factors in the population decline (NMFS 2008a).

Airgun arrays associated with seismic operations produce the loudest underwater noise levels with a general increase in source sound pressure levels with an increase in the total number and volume of the airgun arrays used. Seismic surveys use high energy, low frequency sound in short pulse durations to determine substrates below the seafloor, such as oil and gas deposits (Richardson et al. 1995). In the past, large arrays of greater than 3,000 in^3 have been used with source noise levels exceeding 240 dB re 1 µPa (rms). However, much smaller arrays (440-2,400 in^3) are now being used in Cook Inlet both because of the generally shallow water environment and the increased use of ocean-bottom cable (OBC) and ocean-bottom node (OBN) systems. The amount of energy and size of airgun arrays needed in a seismic project is dependent not only on the depth of the target strata, but the depth of the water as well. With ocean-bottom systems, the receivers are on the ocean floor, so the acoustical signal does not have to penetrate the water column twice (down and reflection back up) before reaching the receivers. All seismic survey programs planned for Cook Inlet in 2015 are likely to be using OBC/OBN systems.

Recent and planned seismic surveys have used or will use maximum airgun arrays of 1,760 and 2,400 in^3 with source levels of about 237 dB re 1 µPa (rms). Shallow water surveys have involved 440, 620, and 880 in^3 arrays with source sound pressure levels less than 230 dB re 1 µPa (rms) range. Measured radii to Level A (190 and 180 dB) from these guns have ranged between 50 m (164 ft) and nearly 2 km (1.2 mi), while Level B (160 dB) radii have ranged from 3 to 7 km (1.8-4.3 mi). Apache conducted seismic surveys in Cook Inlet in 2012 and 2014. In 2012, Apache reported zero takes of either beluga whales or Steller sea lions during over 1,800 hours of seismic activity (2014 results are not yet publically available), due to implementation of mitigation measures including shutdowns (Lomac-MacNair et al. 2013). Apache plans to continue seismic surveys in 2015 and beyond.

G&G activities are usually conducted prior to pipeline or drilling platform placement to look for hazards such as gas pockets, sunken ships, rocks, and other features that might hinder bottom surface or subsurface activities. Geophysical surveys include the use of echo sounders and side-scan sonar, which use high energy sound to detect seafloor objects. However, these equipment generally operate at frequencies well beyond the hearing range of marine mammals (>200 kHz) (Southall et al. 2007). Sub-bottom profilers and small airguns (<90 in^3) are used to identify sub-surface hazards and thus operate at lower frequencies, often within the effective hearing range of beluga whales and sea lions. However, relative to larger airgun arrays, they operate at much lower energies (195-215 dB re 1 µPa; Shores 2013).

Geotechnical activities that produce underwater noise include borings and vibracoring, both of which are methods for obtaining large (6-in) or small (3-in) cores of the ocean floor to analyze the geological properties of the sediments. Borings would be conducted from a small jack-up platform with a small drill rig. Underwater noise levels exceeding 120 dB re 1 µPa (rms) are not expected to be generated by the geotechnical borings associated with this G&G program because the mobile drill rig is located on a platform above the sea surface and the drill rig is cushioned between the rig and the platform deck. Jack-ups for geotechnical borings only have a small deck-mounted generator and pumps, and there is little water contact (no hull-water contact, only with the legs). Vibracoring involves using a submersed motor to “vibrate” a 10.0-cm (4-in) core barrel 6.1 m (20 ft) into ocean floor. Continuous underwater noise associated with vibracoring has been measured at 187.4 dB re 1 µPa-m (rms), with a frequency range of between 10 Hz and 20 kHz (Chorney et al. (2011), resulting in associated underwater noise exceeding 120 dB re 1 µPa-m (rms) to a distance of about 2.5 km (1.5 mi). However, vibracoring only lasts for one or two minutes and generally does not occur more than two or three times in a day. More specific information on G&G activities are found in Section 1.3 of this document.

Underwater noise associated with oil and gas drilling is directly related to the amount of water surface contact with the drilling rig. Thus, jack-up drilling rigs with the drilling platform and generators located above the sea surface and with lattice legs with very little surface contact with the water are relatively quiet as compared to drill ships or semi-submersible drill rigs (Richardson et al. 1995, Spence et al. 2007). Recent exploratory drilling in Cook Inlet has been conducted from jack-up drilling rigs only, including the larger *Spartan 151* and *Endeavour, Spirit of Independence*. Both these drill rigs were hydroacoustically measured in recent years. Marine Acoustics, Inc. (2011) found continuous noise exceeding 120 dB re 1 µPa (rms) to extend to only 50 m (164 ft), while Illingworth and Rodkin (2014) found drilling noise associated with the *Endeavour* to not exceed background levels, although noise associated with the submerged deep-well pumps to exceed 120 dB out to 260 m (853 ft). However, the *Endeavour* left Cook Inlet in 2014 leaving the *Spartan 151* the only current option for a drilling platform in 2015. Both Furie and BlueCrest Energy are considering using the *Spartan 151* for exploratory drilling operations in 2015.

Blackwell and Greene (2002) recorded underwater noise produced at Phillips A oil platform at six locations at distances ranging from 0.3 to 19 km (0.2-11.8 mi) from the platform. The highest recorded sound level was 119 dB re: 1 µPa at a distance of 1.2 km (0.75 mi). The operating noise from the oil platform was generally below 10 kHz. In general, noise from the platform itself is thought to be very weak because of the small surface area (the four legs) in contact with the water (Richardson et al. 1995) and that the majority of the machinery is on the deck of the platform, which is above the water surface. However, noise carried down the legs of the platform likely contributed to the higher levels documented by Blackwell and Greene (2002). Most of this noise falls below the most sensitive hearing threshold of beluga whales and sea lions, but it would still be detectable by them at a few kilometers distance.

3.2.2.3 Vessel Traffic Noise

Vessel traffic includes large shipping, commercial and support vessels, commercial fishing vessels, and personal water craft. Vessel traffic can produce noise disturbance to beluga whales. Blackwell and Greene (2002) recorded underwater noise produced by both large and small vessels near the POA. The tugboat *Leo* produced the highest broadband levels of 149 dB re: 1 μPa at a distance of approximately 100 m (328 ft), while the docked *Northern Lights* (cargo freight ship) produced the lowest broadband levels of 126 dB re: 1 μPa at 100 to 400 m (328-1,312 ft). Measured underwater noise from various vessels used during seismic operations operating in the Beaufort Sea ranged between 166.4 and 191.8 dB re 1 μPa (rms) at source, depending on vessel size and operating speed (Aerts et al. 2008). Continuous noise from ships generally exceed 120 dB re 1 μPa (rms) to distances between 500 and 2,000 m (1,640 and 6,562 ft), although noise effects are short term as the vessels are continuously moving. Also, ship noise is generally below 1 kHz, or well below the most sensitive hearing range of beluga whales and Steller sea lions. The Action Area includes shipping lanes leading to the POA, thus shipping noise would contribute to the overall acoustic environment of the Action Area, although NMFS does not regulate sound associated with maritime traffic.

3.2.2.4 Aircraft Noise

Cook Inlet experiences significant levels of aircraft traffic. The Anchorage International Airport (ANC) is directly adjacent to lower Knik Arm and has high volumes of commercial and cargo air traffic. Joint Base Elmendorf Richardson (JBER) also has a runway near and airspace directly over Knik Arm. Lake Hood and Spenard Lake in Anchorage are heavily used by recreational seaplanes. Other small public runways are found at Birchwood, Goose Bay, Merrill Field, Girdwood, the Kenai Municipal Airport, Ninilchik, Homer, and Seldovia. Drilling projects often involve helicopters and fixed-winged aircraft, and aircraft are used for surveys of natural resources including Cook Inlet beluga whales.

Airborne sounds do not transfer well to water because much of the sound is attenuated at the surface or is reflected where angles of incidence are greater than 13°; however, loud aircraft noise can be heard underwater when aircraft are directly overhead and surface conditions are calm (Richardson et al. 1995). Blackwell and Greene (2002) recorded noise levels from jets entering and leaving ANC and JBER. Only about half of the 15 commercial aircraft and 11 F-15 military jets recorded were detectable underwater due to limited sound transmission across the air/water interface. Also, the sound energy recorded from the aircraft were generally broadband and below 2 kHz.

Richardson et al. (1995) discovered that beluga whales in the Beaufort Sea will dive or swim away when low-flying (less than 500 m/1,640 ft) aircraft passed directly above them. However, beluga survey aircraft flying at approximately 244 m (800 ft) in Cook Inlet observed little or no change in beluga swim directions (Rugh et al. 2000, 2005a). This is likely because beluga whales in Cook Inlet have habituated to routine small aircraft over flights. Beluga whales may be less sensitive to aircraft noise than vessel noise, but individual responses may be highly variable and depend on previous experiences, beluga activity at the time of the noise, and characteristics of the noise.

3.2.2.5 Coastal Development Noise

Construction noise in Cook Inlet is associated with activities such as dredging and pile driving. Future construction is planned associated with the POA expansion project and the Knik Arm crossing, but construction associated with either project will not occur in 2015. These are the two projects that have generated the most focus because the locations and amount of pile driving involved have created major concerns of potential harassment to beluga whales. Small and/or private docks also may utilize pile driving as a part of their expansions or repairs, but no planned activities have been identified for 2015.

Dredging is conducted on an annual basis at POA, and it does produce continuous underwater noise. However, this dredging activity will occur near Anchorage outside of the proposed Action Area.

3.2.3 Water Quality and Water Pollution

The Conservation Plan for the Cook Inlet Beluga Whale (NMFS 2008a) states contaminants are a concern for the sustained health of Cook Inlet beluga whales. The principal sources of pollution in the marine environment are: 1) discharges from industrial activities not entering municipal treatment systems; 2) discharges from municipal wastewater treatment systems; 3) runoff from urban, mining, and agricultural areas; and 4) accidental spills or discharges of petroleum and other products (Moore et al. 2000).

3.2.3.1 Salinity and Turbidity

The salinity of Cook Inlet varies significantly south to north, primarily resulting from more and larger streams discharging freshwater into upper Cook Inlet (e.g., Matanuska and Susitna rivers) and from the oceanic influence in lower Cook Inlet. Salinity values as low as 10 parts per thousand (ppt) have been measured at the surface in upper Cook Inlet (Smith 1993, cited in Foster et al. 2010) and as high as 32 ppt near the mouth (Smith 1993, cited in Foster et al. 2010; Okkonen et al. 2009). Hydrographic surveys showed that in central Cook Inlet, mean salinities increase from surface to bottom, from north to south, and from west to east, indicating a mean southward baroclinic (density-driven) flow along the west side of Cook Inlet in the upper part of the water column (Okkonen et al. 2009). Salinity increases rapidly and almost uniformly down the inlet, from Point Possession to East and West Foreland. Slightly higher salinities are found on the east side. This rapid increase can be attributed to the heavily loaded glacial runoff from the Matanuska, Susitna, and Knik rivers and subsequent sediment settling in upper Cook Inlet. Local areas of depressed salinity occur off the mouth of large glacially fed streams, such as the Tuxedni, Kenai, and Kasilof rivers. In Cook Inlet, maximum current speeds average about 5.6 kph (3 kt) in most of the Inlet; however, during monthly extremes currents exceed 12 kph (6.5 kt) in the Forelands area.

Measurements of suspended sediment also vary. Several locations near the river mouths exhibit concentrations of up to 1,000 mg of sediment per liter (mg/L) between water surface and depths of 4.6 m (15 ft), while sediment concentrations at greater water depths have measured more than 4,000 mg/L (Smith et al. 2005). The average natural turbidity in upper Cook Inlet and Knik Arm typically ranges from 400 to 600 nephelometric turbidity units. The turbulent nature of the system mixes the water and maintains relatively high dissolved oxygen concentrations throughout the entire water column.

3.2.3.2 Contaminants Found in Belugas

Because Cook Inlet beluga whales congregate in nearshore environments, they can be exposed to higher concentrations of point and non-point pollution (URS 2010). As contaminants can affect the overall health of beluga whales (Becker et al. 2000, Reiner et al. 2012), and elevated levels of contaminants derived from terrestrial sources has been found in in St. Lawrence estuary beluga populations (Beland et al. 1993), NMFS has identified contaminants as a risk factor relative to Cook Inlet beluga whale population recovery (NMFS 2008a). However, there is very little information on the potentially deleterious effects of chemicals on the Cook Inlet beluga whale population (NMFS 2008a, URS 2010, Reiner et al. 2012).

Nonpoint pollution sources include land runoff, precipitation, atmospheric deposition, drainage, or seepage, that commonly originate from urban development, harbors and marinas, highways and roads, and agriculture (Norman 2011). Point pollution sources generally relate to specific outfalls from industrial facilities or sewage treatment plants, or storm water runoff entering marine waters from a discrete pipe (Norman 2011). Persistent organic pollutants (POPs) of concern include industrial chemicals such as PCBs; pesticides such as DDT, Aldrin, Chlordane, and Dieldrin; and chemical byproducts from waste incineration such as dioxins. POPs are generally lipophilic and will concentrate in whale blubber where they have little health effects to the animal. However, during periods that blubber lipids are most needed, such as during lean food periods or reproduction/lactation, sensitive organs such as liver and kidneys can receive high doses of chemicals leading to health problems such as reproductive impairment and immune suppression. Inorganic pollutants include heavy metals such as mercury, lead, zinc, copper, and arsenic derived from car exhaust, land runoff, treatment plant discharges, and mining. Acute levels of heavy metals can lead to organ damage, especially damage to heart, lungs, kidneys, intestines, and the nervous system.

Since 1992, tissues from Cook Inlet beluga whales have been collected from subsistence harvested and dead stranded beluga whales, when possible, and analyzed for contaminants as part of the Alaska Marine Mammal Tissue Archival Program. These samples were compared to samples taken from beluga whales in two Arctic Alaska locations (Point Hope and Point Lay), Greenland, Arctic Canada, and the Saint Lawrence estuary in eastern Canada (Becker et al. 2000, 2001; Reiner et al. 2012). Cook Inlet beluga whales appear to have lower levels of contaminants stored in their bodies than do beluga whales from other populations, with the possible exception of copper (Becker et al. 2000). Copper is also acutely toxic to salmon (Chapman 1978), a major Cook Inlet beluga whale prey item. However, both Becker et al. (2000) and Reiner et al. (2012) concluded that little is known about the role of chemical stressors in beluga whale health and that future research should continue to examine their interaction and effects on recruitment in declining populations.

3.2.3.3 Storm Water Runoff

Storm water runoff has the potential to carry numerous pollutants from the Municipality of Anchorage (MOA), the Matanuska-Susitna Borough, and the Kenai Peninsula Borough into Cook Inlet. Runoff can include pollution coming from streets, construction and industrial areas, and airports. Runoff can also carry hazardous materials from spills and contaminated sites into Cook Inlet. The importance of storm water as a potential pathogen source is further reinforced by a study conducted in 2003 regarding pathogen inputs at the watershed level for Anchorage (MOA 2003) that identified significant contributors to creeks and streams that release to the Cook Inlet marine environment. Storm water runoff in the MOA is separated from domestic waste and collected from an area of approximately 5,063 km^2 (1,955 mi^2) that includes Eagle River, Girdwood, Chugiak, and Eklutna. The potential discharge volume and efficiency of the storm water system in the MOA is unknown

The ADEC records all reported spills to marine waters in Cook Inlet. Regulations require that any spill to marine water be reported. Oil spills in small amounts are not reported but are documented in a company's oil discharge prevention and contingency plan. At present, any release to water is to be reported immediately, and any release to land in excess of 208 L (55 gal) is to be reported as soon as the discharge is known. Volumes of discharged oil from 3.8 to 37.8 L (1–10 gal) are documented on a monthly spill report log for each facility or vessel.

3.2.3.4 Wastewater Discharge

Ten communities currently discharge treated municipal wastes into Cook Inlet. Wastewaters entering these plants may contain a variety of organic and inorganic pollutants, metals, nutrients, sediments, bacteria and viruses, and other emerging pollutants of concern (EPOCs). Wastewater from the MOA, Nanwalek, Port Graham, Seldovia, and Tyonek receive primary treatment, wastewaters from Homer, Kenai, and Palmer receive secondary treatment, and wastewaters from Eagle River and Girdwood receive tertiary treatment. Primary treatment means that only materials easily collected from the raw wastewater (such as fats, oils, greases, sand, gravel, rocks, floating objects, and human wastes) are removed, usually through mechanical means. The primary effluent is discharged directly into Cook Inlet, where it becomes diluted. Wastewater undergoing secondary treatment is further treated to substantially degrade the biological content of the sewage (such as in human and food wastes). Tertiary treatment plants use technology in addition to primary and secondary treatment to increase the quality of the effluent discharge.

The MOA's John M. Asplund Water Pollution Control Facility (WPCF) located at Point Woronzof handles approximately 219.5 million L (58 million gal) of sewage a day for 220,000 people. The plant has only primary treatment capabilities and has operated on waivers since 1985 (waivers from meeting water quality standards) due to the extreme tidal flows in Cook Inlet. A recent study validated that because of the extreme tidal energy in the study area, the concentration of the WPCF discharge is reduced significantly within the zone of initial dilution (ZID) and continues to reduce rapidly as it moves away from the ZID. Vertical mixing of the discharge is complete throughout the inlet (AWWU Biological Evaluation 2011).

3.2.3.5 Ballast Water Discharges

Vessel discharges will be authorized under the U.S. Environmental Protection Agency's (EPA's) National Pollutant Discharge Elimination System (NPDES) Vessel General Permit (VGP) for Discharges Incidental to the Normal Operation of Vessels. Each vessel will have obtained authorization under the VGP and will discharge according to the conditions and limitations mandated by the permit. As required by statute and regulation, the EPA has made a determination that such discharges will not result in any unreasonable degradation of the marine environment, including:

- Significant adverse changes in ecosystem diversity, productivity, and stability of the biological community within the area of discharge and surrounding biological communities.
- Threat to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms.
- Loss of aesthetic, recreational, scientific, or economic values, which is unreasonable in relation to the benefit derived from the discharge.

3.2.3.6 Oil Spills

While construction of an oil/gas facility may temporarily result in habitat loss, a natural gas blowout or oil spill could severely impact the beluga whales and put the population at risk. According to the ADEC oil spills database, oil spills to marine waters are composed mostly of harbor and vessel spills, and platform and processing facilities, and the total amount of reported oil discharge in Cook Inlet area since July 1, 2013, was 477,942 L (126,259 gal) (from 79 spills) with the largest quantities from produced water, process water, diesel, drilling muds, and aviation fuel. The facility type that accounts for most of the discharged fluids are natural gas and oil production, air transportation, vessel discharges, and mining. The ADEC oil spill database reports that since, July 1, 2013, oil spills to water occur primarily from vessels and harbor activities and from exploration and production facilities. Most vessel and harbor releases are small in nature with the largest being reported as 757 L (200 gal) of diesel at the North Star Terminal in Homer. Discharges from exploration rigs and activities were small in nature from 0.001 to 1.0 gallons composed of hydraulic fluids, and engine lube oil. Similarly, production facilities and platform spills are usually small and composed of diesel, hydraulic fluids drilling muds, ethylene glycol and crude oil. The largest oil spill was 3,180 L (840 gal) of crude oil on the Granite Point Platform of which 2,703 L (714 gal) were contained.

Related effects from one of these events could include death or injury from swimming through oil (skin contact, ingestion of oil, respiratory distress from hydrocarbon vapors), contaminated food sources, or displacement from foraging areas (NMFS 2008a).

3.2.4 Prey Reduction

Several fisheries occur in Cook Inlet waters and have varying likelihoods of competing with beluga whales for fish due to differences in gear type, species fished, timing, and location of the fisheries. Given that beluga whales concentrate in upper Cook Inlet during summer (Rugh et al. 2010), fisheries that occur in those waters during spring and summer could have a higher likelihood of interacting with beluga whales.

Fisheries may compete with beluga whales in Cook Inlet for salmon and other prey species. There is strong indication that these whales are dependent on access to relatively dense concentrations of high value prey throughout the summer months. A significant reduction in the amount of available prey may impact the energetics of Cook Inlet belugas and delay recovery.

3.2.4.1 Commercial Fisheries

Commercial fisheries in upper Cook Inlet begin at the end of June. The Alaska Department of Fish and Game (ADF&G) has management responsibility for most of the commercial fisheries in Cook Inlet, with the exception of halibut and a few federally managed fisheries in the lower Inlet. The state-managed fisheries in the upper and mid Inlet include salmon (both set and drift gillnet), herring (gillnet), a recently reopened dip net fishery for eulachon (a.k.a. hooligan or smelt), and a razor clam (*Siliqua patula*) fishery. The largest fisheries in Cook Inlet, in terms of participant numbers and landed biomass, are the state-managed salmon drift and set gillnet fisheries concentrated in the Central and Northern Districts of the Upper Cook Inlet Management Area. Even though all five types of Pacific salmon are caught in the upper Inlet, sockeye salmon (*Onchorhynchus nerka*) is the primary target of the salmon commercial fisheries. Times of operation change depending upon management requirements, but in general the drift fishery operates from late June through August, and the set gillnet fishery during June through July. Salmon fishery effort varies between years, and within-year effort can be temporally and spatially directed through salmon management regulations.

Commercial fishing for halibut in Cook Inlet is managed by the International Pacific Halibut Commission (IPHC). The IPHC manages stocks of Pacific halibut within agreement waters of the United States and Canada. Cook Inlet falls in regulatory area 3A, which also includes a portion of the Gulf of Alaska. In Cook Inlet, this fishery primarily operates in mid and lower Inlet waters.

3.2.4.2 Recreational, Personal Use, and Subsistence Fisheries

Recreational fishing is a very popular sport in Alaska, as evidenced by the intensive fishing during salmon runs and the large number of charter fishing operations. There are numerous recreational fishing areas targeting primarily salmon, including the hundreds of drainages of the Susitna River, the Little Susitna River, the west Cook Inlet streams, the Kenai River, and areas around Anchorage such as Ship Creek. Fish counts in recent years have led to reduced fishing openings, and closure of many harvest areas.

Cook Inlet is a non-subsistence area as defined by Alaska statutes (AS 16.05.258(c)) as "areas where dependence upon subsistence (customary and traditional uses of fish and wildlife) is not a principal characteristic of the economy, culture, and way of life," although personal-use fishery participants remain very possessive of their fishing rights.

Since 2003, Alaskans harvest between 130,000 and 540,000 sockeye salmon annually. Through the *Kenai River Late-Run Sockeye Salmon Management Plan* the ADF&G manages the upper Cook Inlet commercial fisheries to minimize the harvest of Northern District coho salmon

(*Oncorhynchus kisutch*), late-run Kenai River king salmon, and Kenai River coho salmon to leave fish for personal use. This program includes the Kenai River personal use salmon dip-netting.

Kenai River king salmon and other king salmon stocks throughout Cook Inlet are experiencing a period of low productivity and, since 2009, below average strength. That trend is anticipated to continue during the 2015 season. The 2015 preseason forecast for early-run Kenai River king salmon is for a total run of approximately 5,200 fish in the Kenai River.

Recent concern regarding the volume of harvestable clams in the Ninilchik and Clam Gulch areas of Cook Inlet has resulted a 2015 closure to clamming in the east side Cook Inlet beaches. The cause of the decline in razor clam abundance on eastside Cook Inlet beaches is unknown but is thought to have resulted from poor recruitment.

Fishing for eulachon (commonly referred to as hooligan) is popular in Turnagain Arm, with no bag or possession limits. The two most significant areas where eulachon are harvested in personal use fisheries are the Twentymile River (and shore areas of Turnagain Arm near Twentymile River) and Kenai River. Personal-use eulachon fishing takes place in the spring by dip-net or drift gillnet. Currently, no subsistence records are kept for eulachon or herring harvests (ADF&G 2014).

There is currently no annual sac roe harvest of herring in upper Cook Inlet.

3.2.5 Direct Mortality

There are several means by which Cook Inlet beluga whales may die or be killed. This section summarizes the known and potential human and natural causes of direct mortality.

3.2.5.1 Subsistence Harvest

Tyonek is the only tribal village in upper Cook Inlet with a tradition of hunting beluga whales. However, a series of moratoriums have been placed on the Cook Inlet beluga subsistence harvest beginning in 1999, following severe harvest pressure in the mid-1990s that saw annual removals of 10 to 15 percent of the population (Mahoney and Shelden 2000) and resulted in a population decline from an estimated 1,300 whales in 1979 (Calkins 1989) to a recent estimate of 340 animals (Allen and Angliss 2014). Tyonek subsistence hunters were not involved with the high harvest activity in the 1990s (this was largely conducted by Anchorage-based hunters), and their harvest numbers remained low (Stephen R. Braund & Associates and Huntington Consulting {SRBA and HC} 2011). Annual village harvests between 1980 and 2000 generally averaged less than one beluga (Fall et al. 1984, SRBA and HC 2011). Although only five whales have been harvested since 1999 (Hobbs et al. 2008, Allen and Angliss 2014), the population has continued to decline. No future subsistence harvest is planned until after the five-year population average has grown to at least 350 whales and, thus, no beluga harvest is authorized for 2015 when the G&G surveys would occur.

3.2.5.2 Poaching and Illegal Harassment

While the potential for illegal harvest of Cook Inlet beluga whales exists, especially given many areas where belugas occur are remote, no incidents have been reported to date. Unauthorized harassment has been investigated by NMFS enforcement, but there have been no convictions as of 2008 (NMFS 2008a).

3.2.5.3 Incidental Take by Fisheries

Incidental take of marine mammals includes unintended catch or entanglement of animals in fishing gear (NMFS 2008a). There have been no recently reported incidents of Cook Inlet beluga whale interactions with fisheries. Murray and Fay (1979) stated that five beluga were caught in the Cook Inlet salmon gillnet fisheries in 1979, and Burns and Seaman (1986) estimated that three to six whales were taken annually by Cook Inlet salmon fisheries in the early 1980s. There have also been some sporadic reports of entanglement since then (NMFS 2008a), and a possible direct mortality in a subsistence net in 2012. However, various observer and self-reporting logbook data collected during the 1990 to 2000 salmon gillnet fisheries did not report any beluga mortalities (NMFS 2008a).

Both humpback whales and Steller sea lions occasionally become entangled in fishing gear. However, the only fisheries-related mortalities of Steller sea lions reported to NMFS between 2007 and 2011 that involved possible salmon fishing gear were of two animals that were found in poor condition that appeared to have ingested hooks with trailing flashers or leader (Allen and Angliss 2014). There were no reports of entanglement in salmon gillnets.

Allen and Angliss (2014) reported that the mean annual mortality of humpback whales due to entanglement in gillnet gear was 1.2 animals for the period of 2007 to 2011. Humpbacks may be more susceptible to gear entanglement than sea lions and beluga whales, including salmon gillnet fisheries in lower Cook Inlet; however, these large whales are not expected to occur in the Action Area.

3.2.5.4 Stranding

Live stranding occurs when a marine mammal is found in waters too shallow to swim. Live stranding is very rare and not an issue of concern for humpback whales and Steller sea lions because the former forages in deeper waters and the latter is capable of walking. However, live strandings are not uncommon in beluga whales as they naturally inhabit shallow water environments. Strandings can be intentional (e.g., to avoid killer whale predation), accidental (e.g., chasing prey into shallows then trapped by receding tide), or a result of illness or injury (NMFS 2008a). Cook Inlet beluga whales are probably predisposed to stranding because they breed, feed, and molt in the shallow waters of upper Cook Inlet where extreme tidal fluctuations occur, especially in Turnagain Arm. Between 1988 and 2008, more than 700 whales have been stranded in upper Cook Inlet, with only 20 associated deaths (Vos and Shelden 2005, NMFS 2008a). Still, Hobbs et al. (2006) recognized that stranding was a constant threat to the Cook Inlet beluga whale recovery and determined this declining population could not easily recover from multiple mortalities that resulted from a mass stranding event. All these strandings occurred in Turnagain Arm, Knik Arm, Susitna River, or Kenai River outside the Action Area.

3.2.5.5 Predation

Killer whales occasionally enter Cook Inlet and prey upon beluga whales (Shelden et al. 2003). They can also cause beluga whales to strand, which in itself could result in mortality. Predation events, although rare, have been reported throughout Cook Inlet, and could occur within the Action Area. The annual average number of beluga whales killed by killer whales has been estimated at a low one per year (Shelden et al. 2003). However, given the small size of the Cook Inlet beluga whale population, killer whale predation could still significantly impact beluga whale recovery.

3.2.6 Ship Strikes

Humpback whales are large and ponderous, and rest at the surface, often within or near shipping lanes or in inland waters where fishing boats and recreational boats are common. Allen and Angliss (2014) estimated that the annual humpback mortality from vessel collisions in Alaskan waters is about two animals per year. Ship strikes from G&G vessels are not an issue with humpback whales since survey vessels will not exceed speeds of 7.4 to 9.3 kph (4 to 5 kt). The jack-up barge will also be towed by a tug at speeds less than 10 kts. Most strikes of baleen whales occur when vessels are traveling at speeds exceeding 24 kph (13 kt) (http://www.nmfs.noaa.gov/pr/pdfs/shipstrike/ss_speed.pdf). Also, humpback whale occurrence in the Action Area is extremely remote at best, with the likelihood of a humpback whale vessel encounter to be discountable.

Cook Inlet beluga whales may be susceptible to ship strike mortality when they occur within commercial shipping lanes leading to POA or Port MacKenzie, although only one whale death (in 2007) has been attributed to ship strike based on blunt force injuries (NMFS 2008a). Beluga whales may more likely be susceptible to strikes from commercial and recreations fishing vessels given all can occur where salmon congregate. A number of Cook Inlet beluga whales have been photographed with propeller scars (Burek 1999a,b,c; Kaplan et al. 2009; McGuire et al. 2009, 2011), suggesting that small vessel ship strikes are not rare, but strikes are often survivable. Again, the vessels will not exceed 7.4 to 9.3 kph (4 to 5 kt) while surveying.

Ship strike has not been reported as a significant mortality factor for Steller sea lions in Alaska (Allen and Angliss 2014). Sea lions are agile and can see long distances above water, both factors that may allow them to avoid ship strike.

3.2.7 Research

Research is a necessary endeavor to assist in the recovery of the Cook Inlet beluga population, and a number of research activities are occurring or have recently occurred in Cook Inlet. However, research can also cause disturbance of whales, especially activities that include animal capture, drawing blood and tissue samples, or attaching tracking devices such as satellite tags. Stress during capture may also lead to mortality. Aerial surveys could also potentially disturb Cook Inlet whales, especially where circling low-altitude flights are conducted to obtain accurate groups counts. A summary of recent Cook Inlet research activities follows.

NMFS Aerial Surveys – Between 1993 and 2012, NMFS conducted annual summer surveys for Cook Inlet beluga whales (Rugh et al. 2000, 2005a, Shelden et al. 2013), and biennially beginning in 2014 (Hobbs 2013). The primary objectives of these surveys are to document sighting locations and count belugas in Cook Inlet while maintaining continuity with preceding studies to allow for inter-year trend analyses (Shelden et al. 2013). All surveys were conducted from twin-engine, high-wing aircraft (i.e., an Aero Commander or Twin Otter) at a target altitude of 244 m (800 ft) (Shelden et al. 2013). The survey altitude was chosen to maximize the visual range relative to target size while minimizing whale disturbance (Goetz et al. 2012). However, disturbance remains a possibility as with all marine mammal aerial surveys.

NMFS Satellite Tagging – Between 1999 and 2002, NMFS placed satellite tags on 14 beluga whales in upper Cook Inlet (Hobbs et al. 2005, Goetz et al. 2012) and tracked their year-round movement. One whale was tracked for less than two days, and may have been a post-tagging mortality.

LGL Photoidentification – Researchers from LGL Alaska Research, Inc., have photographed beluga whales in upper Cook Inlet (and later Kenai Peninsula) as part of a photographic-identification project since 2005. Photographs are taken from small boats and on land, and later analyzed and cataloged (McGuire et al. 2014). Two catalogs have been developed, one for each the left and right sides of the photographed whales. Because these studies often require a very close approach to whales to obtain clear photographs, they have the potential to cause short-term harassment.

Acoustic Monitoring – A number of acoustical studies have occurred in Cook Inlet both to characterize the acoustical environment and to passively monitor for vocalizing beluga whales. Measurements of background and industrial noise levels have been conducted by Blackwell and Greene (2002), URS (2007), Hotchkin et al. (2009), the Alaska Department of Fish and Game (Small 2010), Austin and Warner (2013), Heath et al. (2014), and Illingworth and Rodkin (2014). Acoustic monitoring for the presence of beluga whales has been conducted by Širović and

Kendall (2009), Small (2010), Castellote et al. (2013), and Lammers et al. (2013). Other than using a boat to deploy and recover hydrophones, acoustical monitoring generally does not directly affect beluga whales.

Industrial Activity Monitoring – In recent years marine mammal monitoring, especially for beluga whales, has been conducted in association with the POA expansion project, and baseline environment data were collected for the Knik Arm Bridge and Toll Authority (KABATA) project. Neither project will be active in 2015, but there are future plans to reactivate both.

BlueCrest Alaska Operating plans to recommence drilling operations at the Cosmopolitan State lease that they initially started with Buccaneer Alaska Operating in 2013. As in 2013, BlueCrest intends to station marine mammal observers aboard the drill rig (possibly the *Spartan 151*) during pipe driving and vertical seismic profiling activities. The Cosmopolitan State lease is located about 4.8 km (3 mi) offshore Cape Starichkof, and 90 km (55 mi) south of the Marine Terminal G&G survey area.

Apache Alaska Corporation plans to conduct 3-D seismic surveys in Cook Inlet in 2015. The exact area of where Apache will survey has not been delineated yet, but could occur anywhere in upper Cook Inlet south of Critical Habitat Area 1 and in lower Cook Inlet in state waters north of Anchor Point. As occurred with Apache's 3-D surveys in 2012 and 2014, marine mammal observers will be stationed aboard the seismic source vessels to monitor safety zones and ensure the seismic program does not result in Level A harassment take of marine mammals. Apache is in the process of receiving a Letter of Authorization (LOA) from NMFS authorizing Level B harassment take of marine mammals associated with its 2015 to 2020 survey plans. It is not yet clear whether Apache's 2015 operations could occur within the Action Area described herein.

Diet Studies – To better understand the food requirements of Cook Inlet beluga whales, diet studies have been conducted that included using stable isotope analysis on bone tissues (from stranded and past harvested animals) as a means of estimating prey composition (Nelson and Quakenbush 2011), and winter trawl surveys to assess the diversity and abundance of potential winter prey and measure polynuclear aromatic hydrocarbon contaminant levels in collected prey items (Saupe et al. 2014). Neither study involved working directly with live beluga whales, thus neither represented a harassment risk to these whales other than any disturbance to wintering whales from trawl surveys.

3.2.8 Environmental Change

The Arctic environment is experiencing a rapid shift in environmental stability (Walsh 2008), which poses a challenge to Arctic marine mammals (Moore and Huntington 2008). Beluga whales seasonally breed and feed in nearshore waters during the summer, but are ice-associated during the remaining part of the year. Ice fields can offer protection from predators, and in some regions support prey such as ice-associated cods. However, the trend for a warmer Arctic climate could profoundly affect the current ecology of Alaskan beluga whales.

Moore and Huntington (2008) suggested that belugas and other ice-associated marine mammals might benefit from warmer climates as areas formerly covered in ice would be available to forage. However, given the limited winter prey available in upper Cook Inlet, less winter ice might not benefit the Cook Inlet beluga stock. Reeves (2009) stated that the bigger threat of climate change to belugas may not be the direct change in climate, but rather the effects of regional warming on increased human activity. Less ice would mean increased vessel activity with an associated increase in noise, pollution, and a higher risk of ship strike. Other factors include changing prey composition, increased killer whale predation due to lack of ice refuge, increased susceptibility to ice entrapment due to less predictable ice conditions, and increased competition with co-predators.

Specific to Cook Inlet beluga whales, the greatest climate change risks would be where it might change salmon and eulachon abundance, and any increase in winter susceptibility to killer whale predation. Also, more rapid melting of glaciers might significantly alter the silt deposition in the Susitna Delta, potentially altering habitat for prey (NMFS 2008a). However, the magnitude of these potential effects is unpredictable, and the isolation of beluga whales within Cook Inlet since the last ice age suggests a strong resilience to environmental changes.

The change in water temperature may in turn affect zooplankton biomass and composition and hence prey availability for humpback whales. Plankton is mostly influenced by changes in temperature, which may affect their metabolic and developmental rates, and possibly survival rates (Batten and Mackas 2007). Changes in temperature affect changes in zooplankton, which in turn may influence changes in fish composition, and hence, alter the quality and types of fish available for beluga whales and Steller sea lions, although it is possible that the physical structure of Cook Inlet and its dominance by freshwater input act to buffer waters from the open ocean (NMFS 2008a).

4.0 EFFECTS OF THE ACTION

4.1 INTRODUCTION AND DEFINITION AND TERMS

Effects of a proposed action are defined under the ESA (50 CFR 402.02):

"…the direct and indirect effects of an action on the species or habitat together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline. The environmental baseline includes the past and present impacts of all federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation process."

The different types of effects that need to be analyzed are further defined:

Direct Effects – Those immediate effects caused by the proposed action and occurring concurrently with the proposed action.

Indirect Effects – Those effects that are caused by the proposed action and are later in time but still are reasonably certain to occur.

Cumulative Effects – As defined in the ESA, cumulative effects are future state, tribal, local, or private activities, not involving federal activities, which are reasonably certain to occur within the action area of the proposed action.

Interrelated Actions – Those actions that are a part of a larger action and depend on the larger action for justification.

Interdependent Actions – Those actions that have no independent utility apart from the action under consideration.

This BA covers the potential effects of the Alaska LNG Project's proposed G&G activities on the endangered humpback whale, Cook Inlet beluga whale, and Steller sea lion, as well as on designated critical habitat for the latter two species (no critical habitat has been designated for humpback whales in Alaska). Existing and potential mitigation measures are also identified and discussed. The proposed 2015 G&G activities are interrelated with future Marine Terminal and pipeline crossing construction, but no interdependent actions have been identified.

For each species, there are three possible determinations of effects, as defined by the ESA:

No Effect – The proposed action or interrelated or interdependent actions will not affect (positively or negatively) listed species or their habitat.

May Affect, Not Likely to Adversely Affect – The proposed action or interrelated or interdependent actions may affect listed species or their habitat, but the effects are expected to be insignificant, discountable, or entirely beneficial. Insignificant effects relate to the size of the impact and should never reach the scale where a take will occur. Discountable effects are those that are extremely unlikely to occur. Based on best judgment, one would not 1) be able to meaningfully measure, detect, or evaluate insignificant effects; or 2) expect discountable effects to occur. Beneficial effects are contemporaneous positive effects with no adverse effects to listed species.

May Affect, Likely to Adversely Affect – The proposed action or interrelated or interdependent actions may have measurable or significant adverse effects on listed species or their habitat. Such a determination requires formal ESA Section 7 consultation. BAs are also intended to make determinations about the effects of the federal action on any designated critical habitat for listed species.

4.2 DIRECT ACOUSTICAL EFFECTS OF G&G EQUIPMENT

4.2.1 G&G Equipment Noise Levels

Almost all the geophysical equipment and some of the geotechnical equipment produce underwater sound. However, some of the equipment, such as the echo sounders and sonar, produce sound at frequencies well above the hearing range of marine mammals, while other equipment types, such as the drill rig for the geotechnical borings, are not expected to produce sound above background levels. G&G equipment that are expected to produce underwater sound levels exceeding NMFS Level B harassment criteria and that operate within the hearing range of humpback whales, beluga whales, and Steller sea lions are found in Table 8 (and previously in Table 2). These are the equipment evaluated as to potential effects to listed marine mammals.

Table 8. Acoustical characteristics of geophysical and geotechnical equipment planned for use in the 2015 G&G Program.

Type	Operating Frequency (kHz)	Source Level (dB re 1 μPa-m [rms])
Sub-Bottom Profiler (Chirp)	2-16	202
Sub-Bottom Profiler (Boomer)	0.5-6	205
Airgun – 0.983 L (60 In^3)	<1	206
Vibracore	0.01-20	188

4.2.2 Background Noise Environment

As mentioned in Section 3.2.2, underwater sound levels in the Cook Inlet are composed of multiple sources, including physical noise, biological noise, and manmade noise. Physical noise includes wind, waves at the surface, currents, earthquakes, ice, and atmospheric noise. Biological noise includes sounds produced by marine mammals, fish, and invertebrates. Manmade noise consists of vessels (small and large), oil and gas operations, maintenance dredging, aircraft overflights, and construction noise. Presumably, background noise levels in the Action Area will remain below 120 dB during calm conditions and rise above 120 dB during storm events or passage of large vessels. During calm conditions, the G&G equipment will contribute to the overall background noise levels during operation out to distances (as much as 10-15 km) where they exceed the current background noise levels.

4.2.3 Potential Noise Effects on Marine Mammals

4.2.3.1 Masking

Marine mammal communication is not expected to be disrupted except when industrial sound frequencies overlap frequencies used by marine mammals in communication. Small airguns typically produce sound at frequencies less than 1 kHz (Richardson et al. 1995, Zykov and Carr 2012), while the sub-bottom profilers operate at frequencies of 2 to 16 kHz (chirp) and 0.5 to 6 kHz (boomer) (Shores 2013; Table 2). The broadband noise of the vibracorer has been measured at between 0.01 and 20 kHz (Chorney et al. 2013).

Beluga whales have a well-developed and well-documented sense of hearing. White et al. (1978) measured the hearing of two belugas whales and described hearing sensitivity between 1 kHz and 130 kHz, with best hearing between 30 kHz to 50 kHz. Awbrey et al. (1988) examined their hearing in octave steps between 125 Hz and 8 kHz, with average hearing thresholds of 121 dB re1 µPa at 125 Hz and 65 dB re 1 µPa at 8 kHz. Johnson et al. (1989) further examined beluga hearing at low frequencies, establishing that the beluga whale hearing threshold at 40 Hz was 140 dB re 1 µPa. Ridgway et al (2001) measured hearing thresholds at various depths down to 984 ft (298 m) at frequencies between 500 Hz and 100 kHz. Beluga whales showed unchanged hearing sensitivity at this depth. Lastly, Finneran et al. (2005) measured the hearing of two belugas, describing their auditory thresholds between 2 kHz and 130 kHz. In summary, these studies indicate that beluga whales hear from approximately 40 Hz to 130 kHz, with maximum sensitivity from approximately 10 to 70 kHz (Wartzok and Ketten 1999). It is important to note that these audiograms represent the best hearing of belugas, measured in very quiet conditions. These quiet conditions are rarely present in the wild, where high levels of ambient sound may exist, especially in Cook Inlet where strong tidal currents can produce ambient sound levels well above 100 dB (Lammers et al. 2013; Section 4.2.2).

Beluga whales are Type II vocalizers in that they tend to occur in social groups and much of the purpose of their vocalizations is to communicate with other group members (Wartzok and Ketten 1999). They communicate with a variety of sounds, but most especially with whistles in the 0.1 to 35 kHz range. Their vocalizations generally occur at frequencies at the lower end of their maximum sensitivity hearing range, but given the communication is probably with nearby group members, maximum hearing sensitivity is unnecessary. Both the hearing and communication ranges of beluga whales overlap with the 0.5 to 16 kHz frequency range of the two sub-bottom profilers, but because the sound intensity levels with sub-bottom profilers is low, the area ensonified by masking levels of noise is very small. The ensonified areas associated with the small airgun are larger, but the airgun frequencies are less than 1 kHz, leaving considerable bandwidth for communicating and hearing. The continuous noise associated with the vibracoring has the potential to mask beluga communication, but only for the one to two minutes the vibracorer operates.

While there are no published data on seismic effect on sea lions, anecdotal data and data on arctic seals indicate that sea lions and other pinnipeds generally tolerate strong noise pulses (Richardson et al. 1995). Any masking effects would also be short-term given the nature of the activity (e.g., small zones of influence, moving vessels, and short operation periods). There would be no effects to critical habitat as none is present in the Action Area.

Masking is of special concern for baleen whales, such as humpback whales, that vocalize at low frequencies over long distances, as their communication frequencies overlap with anthropogenic noises such as shipping traffic and seismic airgun frequencies. Some baleen whales have adjusted their communication frequencies, intensity, and call rate to limit masking effects. For example, McDonald et al. (2009) found that California blue whales (*Balaenoptera musculus*) have shifted their call frequencies downward by 31 percent since the 1960s, possibly in an attempt to communicate below shipping noise frequencies. Melcon et al. (2012) found blue whales to increase their call rates in the presence of shipping noise, but to significantly decrease call rates when exposed to mid-frequency sonar. Also, Di Iorio and Clark (2010) found blue whales to communicate more often in the presence of seismic surveys, which they attributed to compensating for an increase in ambient noise levels. Fin whales (*Balaenoptera physalus*) have reduced their calling rate in response to boat noise (Watkins 1986), and were thought to stop singing altogether for weeks in response to seismic surveys (International Whaling Commission 2007).

In summary, beluga whales and Steller sea lions, the two listed species most likely to be encountered during the G&G Program, have maximum hearing sensitivity well above the low frequency sound levels expected to be generated by the proposed small airgun, the loudest impulsive equipment to be used. These species also vocalize at frequencies that range well above airguns. Operation of the small airgun is unlikely to mask local marine mammal communication because of its operating frequency range and short timeframe . Other equipment have either too small of zones of influence (sub-bottom profilers) or such small operating periods (vibracoring) to pose a masking risk to Cook Inlet marine mammals.

4.2.3.2 Disturbance

Humpbacks, gray whales, and other large baleen whales have shown strong overt reactions to impulsive noises, such as large seismic operations, at received levels between 160 and 173 dB re 1 μPa rms (Richardson et al. 1986, Ljungblad et al. 1988, Miller et al. 1999, 2005, McCauley et al. 2000). The small airgun proposed for the G&G program is much smaller than these seismic airgun arrays and is similar in size to the small mitigation airguns used in conjunction with larger arrays to alert marine mammals of the presence of the operation. However, baleen whales seem to be less tolerant of continuous noise (Richardson and Malme 1993), often detouring around drilling activity when received levels are as low as 119 dB re 1 μPa rms (Malme et al. 1983, Richardson et al. 1985). Based on the previously cited studies, NMFS developed the 120 dB re 1 μPa rms harassment criteria for continuous noise sources. If humpback whales were present, it is likely that they would react to operating G&G equipment by avoiding the immediate vicinity of the operation, with the added advantage of the whales self-avoiding exposure to higher sound levels.

Researchers have noted behavioral changes in captive beluga whales and other odontocetes when exposed to very loud impulsive sound similar to seismic airguns (Finneran et al. 2000, 2002). Field observations in the Beaufort Sea reported evidence of belugas avoiding large array seismic operations (Miller et al. 2005). Further, Romano et al. (2004) exposed a captive beluga whale to airgun sound levels and found that the whale produced stress-level hormones with increasing sound pressure levels, and some hormone levels remained high as long as an hour after exposure (but these hormone levels were far less than those produced during beluga whale chase and capture events). Although the above observations occurred during beluga exposure to sound pressure levels above those that would be produced by the much smaller 0.983 L 60 in^3 airgun arrays proposed, they do demonstrate that beluga are susceptible to sound-induced stress and may avoid high sound levels as a result, leading to potentially limited use of the available habitat.

Pinnipeds in general appear somewhat tolerant of underwater industrial sounds, partially because they can escape underwater pressure levels by exposing their head above the water surface, and they are less sensitive to lower frequency sound pressure levels. In her review of the known effects of sound on marine mammals, Weilgart (2007) largely confined her discussion on cetaceans and only once mentioned a possible negative effect on pinnipeds. Richardson et al. (1995) were not aware of any detailed data on reactions of pinnipeds to, for example, seismic sound energy, and expected them to tolerate or habituate to underwater seismic sound energy, especially if food sources were present. However, Calambokidis and Osmek (1998) did find harbor seal (*Phoca vitulina*) and California sea lion (*Zalophus californicus*) sighting distances to be longer in the presence of seismic activity in Puget Sound.

Most information on the reaction of pinnipeds to boats relate to disturbance of hauled out animals. There is little information on the reaction of these pinnipeds to ships while in the water other than some anecdotal information that sea lions are often attracted to boats (Richardson et al. 1995).

4.2.3.3 Threshold Shift

Noise has the potential to induce temporary (TTS) or permanent (PTS) hearing loss (Weilgart 2007). The level of loss is dependent on sound frequency, intensity, and duration. Similar to masking, hearing loss reduces the ability for marine mammals to forage efficiently, maintain social cohesion, and avoid predators (Weilgart 2007). For example, Todd et al. (1996) found an unusual increase in fatal fishing gear entanglement of humpback whales to coincide with blasting activities, suggesting hearing damage from the blasting may have compromised the ability for the whales to use sound to passively detect the nets.

Experiments with captive bottlenose dolphins and beluga whales found that short duration impulsive sounds can cause TTS (Finneran et al. 2002). Finneran et al. (2002) exposed a single beluga whale to single impulsive sound at a received level equivalent to 228 dB re 1 μPa (peak-peak), which resulted in a 6 dB TTS at 30 kHz. Within four minutes, the threshold returned to near the pre-exposure level. Later, Finneran et al. (2005) suggested that a sound exposure level of 195 dB re 1μPa^{2}s is the likely threshold for onset of TTS in beluga whales. Still, only 18 percent of exposures to an SEL of 195 dB re 1μPa^{2}s resulted in measurable TTS leading the authors (Finneran et al. 2002, 2005) to recommend caution in interpreting the results given the small amount of TTS that was actually detected. Lucke et al. (2009) exposed harbor porpoise to high impulsive sound levels and found that TTS was induced at received sound pressure levels of about 200 dB re 1 μPa (peak-peak) with behavioral aversion to impulsive sounds as low as 174 dB re 1 μPa (peak-peak), indicating a greater sensitivity to impulsive sound than beluga whales. As context, in all these experiments beluga whales were exposed to sound levels much louder than the potential exposure from the sub-bottom profilers and small airgun proposed for this G&G project.

In general, pinnipeds are tolerant of high noise levels (Richardson et al. 1995), and have the ability to escape underwater noises for short periods by keeping their head above water. Sound exposures that elicit TTS have been studied in harbor seals and sea lions (Southall et al. 2007). Only one study (Finneran et al. 2003) has measured pinniped TTS-onset from impulsive noises, and found no measurable TTS in California sea lions following exposures up to 183 dB re 1 μPa (peak-peak).

PTS occurs when continuous noise exposure causes hairs within the inner ear system to die. This can occur due to moderate durations of very loud noise levels, or long-term continuous exposure of moderate noise levels. However, PTS is not an issue with impulsive seismic noise, and continuous noise from the vibracoring or cavitation of boat propellers are of short term for a given location because vibracoring lasts but a minute or two and the vessels are either constantly moving.

4.2.3.4 Injury and Mortality

The risk of injury or mortality to humpback whales, beluga whales, and Steller sea lions from the G&G project is discountable. The noise sources involved emit sound pressures that are too low to permanently injure listed marine mammals, and operational vessels travel at speeds too low (<18.5 km/hr {10 kt}) to pose a ship strike hazard.

4.2.3.5 Noise Effects on Prey

Acoustical effects to prey resources are limited. Christian et al. (2004) studied seismic energy impacts on male snow crabs (*Chionoecetes* sp.) and found no significant increases in physiological stress due to exposure to high sound-pressure levels. No acoustical impact studies have been conducted to date on the fish species most likely present during the summer months in Cook Inlet, but studies have been conducted on Atlantic cod (*Gadus morhua*) and sardine (*Clupea* sp.). Davis et al. (1998) cited various studies and found no effects to Atlantic cod eggs, larvae, and fry when received levels were 222 dB. What effects were found were to larval fish within about 5.0 m (16 ft), and from air guns with volumes between 49,661 and 65,548 cm^3 (3,000 and 4,000 in^3). Similarly, effects to sardine were greatest on eggs and two-day larvae, but these effects were greatest at 0.5 ft (1.6 ft), and again confined to 5.0 m (16 ft). Further, Greenlaw et al. (1988) found no evidence of gross histological damage to eggs and larvae of northern anchovy (*Engraulis mordax*) exposed to seismic air guns, and concluded that noticeable effects would result only from multiple, close exposures. Based on these results, much lower energy impulsive geophysical equipment planned for this program would not damage larval fish or any other marine mammal prey resource in Cook Inlet.

4.2.4 Noise Criteria

NMFS has developed interim acoustical guidelines for determining noise levels that could result in harassment or injury to marine mammals. The current Level A injury thresholds from these guidelines are 180 dB re 1 μPa (rms) for cetaceans and 190 dB re 1 μPa (rms) for pinnipeds. The Level B harassment thresholds for all marine mammals are 160 dB re 1 μPa (rms) for impulsive noise sources (e.g., sub-bottom profilers and airguns) and 120 dB re 1 μPa (rms) for continuous noise sources (e.g., vibracoring).

Southall et al. (2007) has proposed new criteria by dividing marine mammal species into five functional hearing groups for four categories of noise: single pulse, single non-pulse, multiple pulse, and multiple non-pulse. According to the study results used to develop these categories, sound pressure levels injurious to mid-frequency cetaceans such as a beluga whale might not occur until levels reach 230 dB re 1 μPa. However, the Southall et al. (2007) criteria has not yet been adopted and the current criteria remains in place for 2015.

4.2.5 Determination of Potential Exposures

4.2.5.1 Marine Mammal Densities

Goetz et al. (2012) modeled aerial survey data collected by the NMFS between 1993 and 2008, and developed specific beluga summer densities for each 1-km cell of Cook Inlet (Figure 3). The results provide a more precise estimate of beluga density at a given location than simply multiplying all aerial observations by the total survey effort given the clumped distribution of beluga whales during the summer months. To develop a density estimate associated with the planned Action Area, the ensonified area associated with each activity was overlain a map of the 1-km density cells, the cells falling within each ensonified area quantified, and an average cell density calculated. The summary of the density results is found in Table 9, while the associated ensonified areas and beluga density contours relative to the survey areas within the Action Area are shown in Figure 3.

Table 9. Mean raw densities of beluga whales within the Action Area based on Goetz et al. (2012) Cook Inlet beluga whale distribution modeling.

Action Area	Number of Cells	Mean Density (animals/km^2)	Density Range (animals/km^2)
Terminal Survey Area	386	0.000166	0.000021 – 0.001512
Pipeline Survey Area	571	0.011552	0.000275 – 0.156718

4.2.5.2 Activity Duration

The entire Cook Inlet 2015 G&G Program is not expected to last more than about 12 weeks (84 days). During most (63) of these days the chirp and boomer sub-bottom profiler will produce the loudest sound levels, while airgun use will occur over about 7 days. The equipment would be operated for on average 10 hours per day. Airgun activity will occur only near the proposed Marine Terminal, and during the summer when beluga whale use is primarily limited to the Susitna Delta approximately 65 km (40 mi) north of the airgun area. Vibracoring, with its large ZOI, will occur intermittently over approximately 14 days.

4.2.5.3 Equipment Zones of Influence

The ZOI is the area ensonified by a particular sound source, greater than threshold levels (120 dB for continuous and 160 dB for impulsive). The radius of the ZOI for a particular equipment was determined by applying the source sound pressure levels described in Table 6 to Collins et al.'s (2007) attenuation model of 18.4 Log(r) – 0.00188 derived from Cook Inlet. For those equipment generating loud underwater sound within the audible hearing range of marine mammals (<200 kHz), the distance to threshold ranges between 184 m (604 ft) and 2.54 km (1.58 mi), with ZOIs ranging between 0.106 and 20.26 km^2 (0.041-7.82 mi^2) (Table 10).

Table 10. Summary of distances to the NMFS thresholds and associated ZOIs.

Survey Equipment	Distance to 160 dB Isopleth m (ft)	Distance to 120 dB Isopleth km (mi)	160 dB ZOI km^2 (mi^2)	120 dB ZOI km^2 (mi^2)
Sub-bottom Profiler (Chirp)	184 (604)	N/A	0.106 (0.041)	N/A
Sub-bottom Profiler (Boomer)	263 (863)	N/A	0.217 (0.084)	N/A
Airgun	300 (984)	N/A	0.283 (0.109)	N/A
Vibracore	N/A	2.54 (1.58)	N/A	20.26 (7.82)

Vibracoring will be limited to the central region of the Pipeline survey area and the nearshore region of the Marine Terminal survey area, thus the ensonified area associated with vibracoring with a radius of 2.54 km (1.58 mi) would not extend much beyond the geophysical survey corridors (including where the chirper and boomer surveys would occur). Thus, the maximum ZOI for each area would be based on a 300-m radius associated with both the boomer sub-bottom profiler and the small airgun, and determined as the survey area plus a 300-m (984-ft) buffer around the survey area, or 387 km^2 (149 mi^2) for the Marine Terminal survey area and 572 km^2 (221 mi^2) for the Pipeline survey area.

4.2.5.4 Potential Exposures Calculations

The numbers of marine mammals that might be exposed to sound pressure levels exceeding NMFS Level B harassment threshold levels due to G&G surveys, without mitigation, were determined by multiplying the average raw density for each species by the maximum ZOI (the survey area plus a 300-m buffer representing the radius of both the boomer and small airgun sound pressure levels to the 160-dB isopleth) for each Action Area. The results are shown in Table 11.

Table 11. Number of beluga whales potentially exposed to received sound levels exceeding Level B thresholds.

Comment [CEJ5]: Add requested authorizations (requested in IHA Application)

Species	Mean Raw Density km² (mi²)	Area	Max. ZOI km² (mi²)	Exposures	Harassment Authorization Requested
Beluga Whale	0.000166 (0.000064)	Terminal	387 (149)	0.06	15
	0.011552 (0.004460)	Pipeline	572 (221)	6.61	
Total				**6.66**	**15**

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There are no exposure estimates for humpback whales and Steller sea lions because their presence in Cook Inlet, and the Action Area in particular, is too rare for density estimates to be calculated. Possible maximum exposure estimates would be less than a single animal.

Estimated marine mammal exposures in Table 11 do not account for proposed mitigation measures. These measures include shutting down or delaying the start of airgun operations when one or several marine mammals approach ZOIs for Level A harassment, delaying start of airgun, subbottom profiler, and vibracore operations when ESA-listed Cook Inlet beluga whales are approaching the Level B harassment zone, or shutting down the airgun for ESA-listed Cook inlet beluga whales approaching the Level B harassment zone. Mitigation measures include protocols to “clear” ZOIs before start of activities. However, because the effectiveness of these measures in unpredictable, and beluga whales generally travel in large groups, the Applicant is requesting authorization for incidental, non-lethal harassment of 15 beluga whales, or approximately twice the number of estimated exposures without mitigation (Table 10).

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4.3 DIRECT WATER QUALITY EFFECTS

The Cook Inlet 2015 G&G Program will result in a number of minor discharges to the waters of Cook Inlet. Discharges associated with the geotechnical borings will include: 1) the discharge of drill cuttings and drilling mud and 2) the discharge of deck drainage (runoff of precipitation and deck wash water) from the drilling platform. ExxonMobil has applied for an Alaska Pollutant Discharge Elimination (APDES) Individual Permit for these discharges, including requests for zones of deposit (ZOD) and mixing zone (MZ) for drilling mud and cuttings. No sanitary/domestic wastewater discharges will occur from the drilling platform. All wastewater will be captured onboard and sent to shore for proper processing and disposal.

Other vessels associated with the G&G surveys will discharge wastewaters that are normally associated with the operation of vessels in transit including deck drainage, ballast water, bilge water, non-contact cooling water, and gray water.

4.3.1 Deck Drainage

Deck drainage discharges will include normal storm water-type non-point source discharges from precipitation, and deck wash-down water consisting of seawater withdrawn at the work site. The jack-up platform is modular and therefore not equipped with scuppers or any collection system that might include an oil/water separator. Special care and consideration will therefore be given to developing and implementing best management practices (BMPs) such as sweeping the deck prior to any wash-down operations to help minimize any discharge of sediment and will drilling mud/drill cuttings. BMPs will also identify potential pollutant sources and aid in eliminating any contaminated discharges. Typical BMPs that will be utilized to minimize and eliminate pollutant discharges are detailed in Section 4.3.3.

Based on an average monthly precipitation recorded in Anchorage for August (peak month for year) of 8.25 cm (3.25 in), the average deck drainage due to precipitation would be 644 L (170 gal) per day (gpd) assuming deck dimensions similar to the *Skate 3*. The predicted maximum daily precipitation is 3.96 cm/day (1.56 in/day), based on a five-year return period for Anchorage (MOA 2007), resulting in a daily maximum discharge rate of approximately 9,464 Lpd (2,500 gpd) as a result of precipitation. When deck washing is taken into account, the average discharge would be increased by approximately 9,085 Lpd (2,400 gpd) assuming that the deck is washed twice per day for an average duration of 20 minutes at a rate of 227 L per minute (Lpm) (60 gallons per minute {gpm}). Therefore, it is assumed that the daily average deck drainage (combined storm water and wash-down water) would be approximately 9,729 Lpd (2,570 gpd), with a peak discharge of approximately 18,550 Lpd (4,900 gpd), based on the assumptions that the deck may be washed more frequently, for periods longer in duration, or that precipitation may be higher than expected.

4.3.2 Drilling Muds and Drill Cuttings at the Seafloor

The discharges of drill cuttings, drilling mud, and deck drainage associated with the geotechnical borings will be within limitations authorized by the ADEC under the APDES. The drill cuttings consist of natural geologic materials of the seafloor sediments brought to the surface via the drill bit/drill stem of the rotary drilling operation, will be relatively minor in volume, and will deposit over a very small area of Cook Inlet seafloor. The drilling mud that is used to lubricate the bit, stabilize the hole, and viscosify the slurry for transport of the solids to the surface will consist of seawater and guar gum (under the trade name of Secovis). Guar gum is a high-molecular weight polysaccharide (galactose and mannose units) derived from the ground seeds of the plant *Cyampsis tetragonolobus*. It is an odorless, nontoxic fluid (FDA 2013) also used as a food additive in soups, drinks, breads, and meat products.

The discharges of drilling muds/drill cuttings for the geotechnical borings are expected to be relatively small and would only occur during removal of the drill stem and casing at the conclusion of drilling at each borehole, or as a result of temporary loss in circulation, which would result in the casing being advanced to regain and maintain pressure. The drilling will include a support casing from the deck to the seabed to contain the drill string and mud, and will utilize rotary drilling with seawater/drilling mud circulation. All drill cuttings will be captured on deck.

4.3.3 Best Management Practices

BMPs will be implemented to prevent, eliminate, and minimize the generation and potential release of pollutants from the geotechnical borings to the receiving waters of Cook Inlet. Example BMPs that will be implemented for the geotechnical borings include the following:

- Appropriate staff training and staffing to ensure compliance.
- Routine equipment maintenance and inspections.
- Pre-mobilization cleaning of equipment.
- Use of secondary containment around mechanical equipment and fuel.
- Availability of spill kits for immediate clean-up.
- Use of nontoxic, plant-derived (nonpetroleum), guar gum-based drilling mud.
- Use of solids control equipment to separate drill cuttings from drilling mud.
- Drilling mud will be recirculated and reused. There will be no discharge of drilling mud until each borehole is completed; when the drill is extracted, limited discharge of mud will occur at the seafloor.
- No sanitary/domestic waste water discharges (wastewater captured onboard and sent to shore for proper processing and disposal).

- Deck kept clean and swept prior to wash-down.

4.3.4 Vessel Discharges

Vessel discharges will be authorized under the EPA's National Pollutant Discharge Elimination System (NPDES) Vessel General Permit (VGP) for Discharges Incidental to the Normal Operation of Vessels. Each vessel will have obtained authorization under the VGP and will discharge according to the conditions and limitations mandated by the permit. As required by statute and regulation, the EPA has made a determination that such discharges will not result in any unreasonable degradation of the marine environment, including:

- Significant adverse changes in ecosystem diversity, productivity, and stability of the biological community within the area of discharge and surrounding biological communities.
- Threat to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms.
- Loss of aesthetic, recreational, scientific, or economic values, which is unreasonable in relation to the benefit derived from the discharge.

4.4 DIRECT EFFECTS TO HABITAT

Project activities that could potentially impact marine mammal habitats include sediment sampling (vibracore, boring, grab sampling) on the sea bottom, placement of the jack-up rig spud cans, and acoustical injury of prey resources (the latter discussed in Section 4.2.3.5). However, there are few benthic resources in the survey area that could be impacted by collection of the small samples (Saupe et al. 2005).

4.4.1 Boring, Sediment Sampling, and Rig Placement

Potential damage to the Cook Inlet benthic community will be limited to the actual surface area of the four spud cans that form the "foot" of each 0.762-m (30-in) diameter leg, the (42) 25.4-cm (10-in) diameter borings, and the (55) 10.4-cm (4.0-in) diameter vibracore samplings (plus a few sediment grab and PCPT samples). Collectively, these samples would temporarily damage about a 100 m^2 (1,076 ft^2) of benthic habitat, extremely small relative to the size (nearly 21,000 km^2/8,108 mi^2) of Cook Inlet. Overall, sediment sampling and acoustical effects on prey resources will have a discountable effect on the marine mammal habitat within the G&G survey area. Some prey resources might be temporarily displaced, but no long-term effects are expected.

4.4.2 Mixing Zone and Zone of Deposit

In their APDES application, ExxonMobil conservatively requested a turbidity MZ of 928-m (3,045-ft) by 105-m (239-ft) near each borehole to address Alaska Water Quality Standards (AWQS) although modeling indicated the actual plumes will likely range from 5–70 m (16-230 ft) long depending on the current speed. Turbidity was identified as the determining pollutant for the discharge of drilling mud and drill cuttings.

Based on modeling of the coarser-grained components of the discharge, a ZOD of 16 m (52 ft) radius with a maximum 0.5 cm (0.2 in) thickness would encompass the area of any significant accumulation near each borehole. While the discharge may result in a slight deposition on the seafloor within the ZOD, the composition of the discharge (natural geologic cuttings and guar gum-and-seawater mud) and the naturally-occurring high energy and turbidity conditions in Cook Inlet make adverse or long-term impacts from this discharge extremely unlikely.

Only one MZ, with an area of 0.1 km^2 (0.04 mi^2), would exist at any one time as the effects in the water column would dissipate within minutes of cessation of the discharge, and the discharge is expected to last less than a minute. A single MZ would encompass an area of about 0.1 km^2 (0.04 mi^2). Combining all the MZs would conservatively encompass an area of 3.9 km^2 (1.5 mi^3), and the 42 ZODs only 3.3 ha (8.2 ac). Compared to the nearly 21,000-km^2 (8,108-mi^2) Cook Inlet, this is an insignificant fraction of listed marine mammal habitat.

4.5 MEASURES TO REDUCE DIRECT EFFECTS

4.5.1 Noise Impacts

To mitigate for potential noise impacts of the G&G operations on listed marine mammals, EMALL prepared and will implement a *Marine Mammal Monitoring and Mitigation Plan* (4MP). The two primary elements of the plan will include establishing safety zones to avoid Level A harassment exposure and monitoring using protected species observers (PSOs). Each is discussed below.

4.5.1.1 Safety Zones

Comment [CEJ6]: Clarify mitigations

The IHA issued by NMFS will establish harassment and safety zones appropriate for cetaceans and pinnipeds in reference to the Zones of Influence (ZOI) surrounding the active G&G equipment. PSOs will record non-listed marine mammals occurring inside the Level B harassment zone, and initiate shutdowns to avoid harassment of beluga whales and any other ESA-listed marine mammals. The Level A safety zone radii for those activities producing noise exceeding 180 and 190 dB re 1 μPa (rms) are provided in Table 12. The method for deriving these radii is found in Section 4.2.5.3. Each of these noise sources will be shut down at an approach of a pinniped to the 190-dB safety zone or for a cetacean approaching the 180-dB safety zone.

Table 12. Safety and harassment zone radii for each G&G equipment type generating sound at frequencies <200 kHz.

Survey Equipment	Safety Zone Radii		Harassment Zone Radii	
	190-dB radius m (ft)	180-dB radius m (ft)	160-dB radius m (ft)	120-dB radius km (mi)
Sub-bottom Profiler - Chirp	5 (16)	6 (20)	184 (604)	N/A
Sub-bottom Profiler - Boomer	7 (23)	23 (75)	263 (863)	N/A
0.983 L (60 $in^{3)}$ Airgun	8 (26)	26 (85)	300 (984)	NA
Vibracore	0	3 (10)	N/A	2.54 (1.58)

4.5.1.2 Monitoring

Qualified and NMFS-approved PSOs will monitor all of the G&G activities that produce underwater noise levels that could potentially affect listed marine mammals. These PSOs will be stationed aboard the survey source vessels (Table 4) during all sub-bottom profile, airgun, and vibracoring operations. For safety and practical reasons, and because boring is not expected to produce underwater noise exceeding 120 dB, monitoring will not occur from the jack-up platform during active boring operations. A single senior PSO will be assigned to oversee all 4MP mandates and function as the onsite person-in-charge (PIC).

Generally, two PSOs will work on a rotational basis during daylight hours with shifts of two to four ~~to six~~ hours. Overall work days for an individual PSO will not exceed 12 hours. Sufficient numbers of PSOs will be available and provided to meet established standards.

The purpose of the 4MP and PSOs is to meet compliance with regulations set in place by NMFS. The IHA application describes measures to ensure disturbance of, and effects on, marine mammals are minimized and documented. This will be accomplished through a vessel-based visual monitoring program. PSOs will implement this program as specified in the NMFS-issued IHA and the associated 4MP. The primary purposes of the vessel-based program are:

- Monitor: Observe the appropriate harassment and safety zones for marine mammals, estimate the numbers of marine mammals exposed to sound and their reactions (where applicable), and document those incidents as required.
- Mitigate: Implement methodologies to include: clearing and ramp-up measures as appropriate; observe for and detect marine mammals within, or about to enter, the applicable safety radii or harassment zones; implement necessary shut-down, power-down, and/or speed/course alteration mitigation procedures when applicable; and advise operational crews of mitigation procedures.

PSOs will conduct monitoring during daylight periods (weather permitting) during G&G activities, and during most daylight periods when G&G activities are temporarily suspended.

Vessel-based visual monitoring is designed to provide:

- The basis for real-time mitigation, as necessary and required by the IHA.
- Information used to determine "Level B takes" of marine mammals by harassment as required by NMFS.
- Data on occurrence, distribution, and activities of marine mammals from areas where operations are conducted.
- Data for the analysis of marine mammal distribution, movement, and behavior relative to program activities.

There are two mitigation measures that will be initiated by the PSOs to avoid Level B Harassment of ESA-listed marine mammals. These include slowing down of the ~~towing operation~~vessels at the approach of listed marine mammals (e.g., beluga whales), thereby reducing cavitation noise and the size of the harassment zone. It also includes shutting down of sub-bottom profiling and airgun equipment at the approach of a listed species to the harassment ZOI, and "clearing" the harassment ZOI before commencing vibracoring by surveying the area in advance of planned operations. (Vibracoring will also be shut down at the approach of a marine mammal, although this scenario is unlikely given vibracoring lasts but one or two minutes, and the site will already have been "cleared" of marine mammals by the PSOs.)

4.5.1.3 Seasonal Avoidance

The G&G activity will occur during the summer months when the majority of the Cook Inlet beluga whale population is concentrated in the Susitna Flats region north of the Action Area. No sub-bottom profiler or vibracorer activity is planned within 5 km (2.7 nm) of the Beluga River.

4.6 INDIRECT EFFECTS

Indirect effects defined under the ESA are effects from the proposed action that occur later in time, but are still reasonably certain to occur. Indirect effects from the proposed Alaska LNG G&G Program include impacts from noise on the habitat that might eventually lead to direct effects on the marine mammals. The proposed action will not result in any permanent impacts (e.g., modifications) on Cook Inlet beluga whale habitat; however, indirect impacts could occur as a result of the action from ensonification of habitat, including temporary displacement of beluga prey species.

4.6.1 Effects on Habitat and Critical Habitat

The proposed project will not result in any modifications to Steller sea lion habitat because the proposed project is located outside Steller sea lion critical habitat, there are no haul-outs or rookeries in the Action Area with large concentrations of Steller sea lions, and Steller sea lions are rarely observed in the Action Area.

The Action Area is also well north of areas where summering humpback whales have been observed. Humpback prey (e.g., zooplankton and schooling fish) do not occur in abundance in the Action Area with the exception of seasonal runs of eulachon.

Potential effects on beluga habitat would be limited to noise effects on prey (discussed in Section 4.2.3.5); direct impact to benthic habitat from jack-up platform leg placement and sampling with grabs, coring, and boring; and the MZs and ZODs of the muds associated with the borings. ESA section 3(5)(A)(i) defines critical habitat to include those ''specific areas within the geographical area occupied by the species at the time it is listed . . .on which are found those physical or biological features . . . (I) essential to the conservation of the species and (II) which may require special management considerations or protection.'' Joint NMFS/FWS regulations for listing endangered and threatened species and designating critical habitat at section 50 CFR 424.12(b) state that the agency ''shall consider those physical and biological features that are essential to the conservation of a given species and that may require special management considerations or protection'' also referred to as ''Essential Features'' or ''Primary Constituent Elements."

When establishing critical habitat for the Cook Inlet beluga whale, NMFS identified the following as the Primary Constituent Elements; an analysis of the potential effects of the survey program on these elements follows.

1. Intertidal and subtidal waters of Cook Inlet with depths <30 feet (9.1 m) (MLLW) and within five miles (8.0 km) of high and medium flow accumulation anadromous fish streams.
2. Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole.
3. The absence of toxins or other agents of a type or amount harmful to beluga whales.
4. Unrestricted passage within or between the critical habitat areas.
5. The absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales.

4.6.1.1 Intertidal and Subtidal Waters

Portions of the survey areas include waters of the Cook Inlet that are <9.1 m (30 ft) in depth and within 8.0 km (5.0 mi) of anadromous streams. Several anadromous streams (Three-mile Creek, Chulitna River, Indian Creek, and two unnamed streams) enter the Cook Inlet within the survey areas. Other anadromous streams are located within 1.3-8.0 km (0.8-5.0 mi) of the survey areas. The survey program will not prevent beluga access to the mouths of these streams and will result in no short-term or long-term loss of intertidal or subtidal waters that are <9.1 m (30 ft) in depth and within 8.0 km (5.0 mi) of anadromous streams. Minor seafloor impacts will occur in these areas from grab samples, PCPTs, vibracores, or geotechnical borings but will have no effect on the area as beluga habitat once the vessel or jack-up platform has left. The survey program will have no effect on this Primary Constituent Element.

4.6.1.2 Primary Prey Species – Pacific salmon, Pacific eulachon, Pacific cod, saffron cod, yellowfin sole

The abovementioned beluga prey species could potentially be affected by the sound generated by geophysical and geotechnical equipment, physical disturbance of the fish habitat, or discharges associated with vessels or geotechnical borings. As discussed in Section 4.2.3.5, the sound generated by geophysical and geotechnical equipment is not expected to damage larval fish.

4.6.1.3 The Absence of Toxins

No toxins will be discharged or otherwise introduced into waters of the Cook Inlet by the Cook Inlet 2015 G&G Program. Small volumes of drilling mud associated with the geotechnical borings will be discharged to the Cook Inlet; however, the drilling mud consists of ambient seawater and guar gum, a nontoxic polysaccharide commonly used as a food additive. The program will have no effect on this Primary Constituent Element.

4.6.1.4 Unrestricted Passage

Belugas may avoid areas ensonified by the geophysical or geotechnical activities that generate sound with frequencies within the beluga hearing range and at levels above threshold values. This includes the chirp sub-bottom profiler with a radius of 184 m (604 ft), the boomer sub-bottom profiler with a radius of 263 m (863 ft), the airgun with a radius of 300 m (984 ft) and the vibracores with a radius of 2.54 km (1.58 mi). The sub-bottom profilers and the airgun will be operated from a vessel moving at speeds of about 4 kt. The operation of a vibracore has a duration of approximately one to two minutes; vibracoring is conducted only once at a given location. Most of the areas where these activities will occur fall within Critical Habitat Area 2 during the summer period when belugas are largely absent (NMFS 2008a). A small (28.5 km^2/11 mi^2) portion of the Pipeline survey area occurs within Critical Habitat Area 1. However, given the size and openness of the Cook Inlet in the survey areas, and the relatively small area and mobile/temporary nature of the zones of ensonification, the generation of sound by the survey program is not expected to result in any restriction of passage by belugas within or between critical habitat areas. Further, no sub-bottom profiler or vibracorer activity is planned within 5 km (2.7 nm) of the Beluga River. Finally, the jack-up platform from which the geotechnical borings will be conducted will be attached to the seafloor with legs, and will be in place at a given location for up to four to five days, but given its small size (Table 4) would not result in any obstruction of passage by belugas. The program will have no effect on this Primary Constituent Element.

4.6.1.5 The Absence of In-water Noise at Levels Resulting in the Abandonment

Operation of the geophysical or geotechnical activities that generate sound with frequencies within the beluga hearing range and at levels above threshold values, and result in temporary displacement of belugas. This includes the chirp sub-bottom profiler with a radius of 184 m (604 ft), the boomer sub-bottom profiler with a radius of 263 m (863 ft), the airgun with a radius of 300 m (984 ft) and the vibracores with a radius of 2.54 km (1.58 mi). The sub-bottom profilers and the airgun will be operated from a vessel moving at speeds of about 4 kt. The operation of a vibracore has a duration of approximately one to two minutes; vibracoring is conducted only once at a given location. Any displacement of belugas would be momentary as the sound sources are either mobile or very brief in duration. No abandonment of the habitat by belugas would be expected. The survey program will have no effect on this Primary Constituent Element.

4.7 INTERRELATED AND INTERDEPENDENT EFFECTS

Interrelated actions are actions that are part of a larger action and depend on the larger action for their justification. The G&G program is a necessary preconstruction step before constructing the natural gas pipeline and Marine Terminal for the Alaska LNG Project. Thus, the eventual construction and operation of the pipeline and terminal are interrelated with the G&G program, although the construction is a future action.

Interdependent actions are actions that have no independent utility apart from the proposed action. No interdependent actions have been identified.

5.0 CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR 402.02 as: "those effects of future State or private activities not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation." Cumulative effects are defined differently under the ESA than they are under NEPA (USFWS and NMFS 1998).

5.1 FISHERIES INTERACTIONS

Fishing is a major industry in Alaska. As long as fish stocks are sustainable, subsistence, personal use, recreational, and commercial fishing will continue to take place in Cook Inlet. As a result, there will be continued prey competition, risk of ship strikes, potential harassment, potential for entanglement in fishing gear, and potential displacement from important foraging habitat for the Cook Inlet beluga whales. NMFS and the ADF&G will continue to manage fish stocks and monitor and regulate fishing in Cook Inlet to maintain sustainable stocks.

5.2 OIL AND GAS DEVELOPMENT

Most of the existing oil and gas development occurs in the Action Area and it is likely that future oil and gas development will continue to take place in the Action Area. Impacts from oil and gas development include increased noise from seismic activity, vessel and air traffic, and well drilling; discharge of wastewater; habitat loss from the construction of oil and gas facilities; and contaminated food sources and/or injury from a natural gas blowout or oil spill. The risk of these impacts may increase as oil and gas development increases; however, new development will undergo consultation prior to exploration and development.

Support vessels are required for oil and gas development to transport supplies and products to and from the facilities. Not only will the support vessels from increased oil and gas development likely increase noise in the Action Area, there is a potential for increased ship strikes with beluga whales.

5.3 COASTAL DEVELOPMENT

Coastal development may result in the loss of habitat, increased vessel traffic, increased pollutants, and increased noise associated both with construction and with the activities of the projects after construction. In the Action Area, two main projects are being considered, the Chuitna Coal Mine and the ORPC Tidal Energy Project.

The Chuitna Coal Project has the potential to affect Cook Inlet belugas and their critical habitat. PacRim is proposing to develop, construct, and operate a coal mine and export facility 19 km (12 mi) northwest of Tyonek. Potential impacts on the Cook Inlet beluga whale from the Chuitna Coal Project would include the construction of the coal export facility and surface water discharge. The coal export facility, which includes an overland coal conveyer and ship loading berth, would extend from shore into Cook Inlet. However, the conveyer and ship berth would incorporate tower sites approximately 335 m (1,100 ft) apart to allow for uninhibited movement of marine life (PacRim Coal, LP 2011). Further, no chemical or water-based processing of the coal would take place; therefore, the expected sources of discharge from the project would be limited to rainfall, snowmelt, and groundwater (PacRim Coal, LP 2011). Prior to discharging water into Cook Inlet, the water would be directed to sediment control structures and meet the water quality criteria described by APDES permit (PacRim Coal, LP 2011). The project is still in the planning phase, and no construction is planned for 2015.

ORPC is proposing two tidal energy projects in Cook Inlet. The first tidal energy project would be located on the west side of Fire Island (near Anchorage) and the second project would be located adjacent to the East Foreland in the vicinity of Nikiski on the Kenai Peninsula (ORPC 2011). The tidal energy projects would require the installation of an array of turbine generator units and transmission cables on the seafloor to harness the tidal energy. The tidal energy will be converted to electrical energy at stations on land. Studies on the acoustical detection of beluga whales were completed in 2013 (ORPC 2014), as was other site assessment work, but no construction is planned in 2015.

Both POA and Port MacKenzie are planning expansion of their facilities, but no construction is planned for 2015. These port facilities may have an effect on beluga whales in the Action Area due to increased vessel traffic passing through the area on their way to the ports.

5.4 POLLUTION

As the population in urban areas continue to grow, an increase in pollutants entering Cook Inlet is likely to occur. Hazardous materials may be released into Cook Inlet from vessels and aircraft. There is a possibility an oil spill could occur from vessels traveling within the Action Area, or that oil could migrate into the Action Area from a nearby spill.

There are many nonpoint sources of pollution within the Action Area; such pollution is not federally-regulated. Pollutants can pass from streets, construction and industrial areas, and airports into Cook Inlet and beluga habitat within the Action Area. Wastewater discharge, gas, oil, and coastal development projects also contribute to pollutants that enter Cook Inlet through discharge. These activities will continue to take place in Cook Inlet; therefore, it would be expected that pollutants could increase in Cook Inlet. However, the EPA and the ADEC will continue to regulate the amount of pollutants that enter Cook Inlet from point and nonpoint sources through NPDES/APDES permits. As a result, permittees will be required to renew their permits, verify they meet permit standards, and potentially upgrade facilities.

5.5 TOURISM

There currently are no boat-based, commercial whale-watching companies in upper Cook Inlet. The popularity of whale watching and the close proximity of beluga whales to Anchorage make it possible that such operations may exist in the near future. However, it is unlikely this industry will reach the levels of intensity seen elsewhere because of upper Cook Inlet's climate and navigation hazards (e.g., shallow waters, extreme tides, and currents), and the Cook Inlet beluga whale's endangered status.

Vessel-based whale-watching may cause additional stresses to the beluga population through increased noise and intrusion into beluga habitat not ordinarily accessed by boats. Avoidance reactions have often been observed in beluga whales when approached by watercraft, particularly small, fast-moving craft that are able to maneuver quickly and unpredictably; larger vessels that do not alter course or motor speed around these whales seem to cause little, if any, reaction (NMFS 2008a). The small size and low profile of beluga whales, and the poor visibility within the Cook Inlet waters, may increase the temptation for whale watchers to approach the beluga whales more closely than usually permitted for marine mammals.

5.6 SUBSISTENCE HUNTING

Alaska Natives, while not currently hunting belugas, may continue to hunt harbor seals in Cook Inlet for subsistence purposes, as allowed by the MMPA. These are typically boat-based hunts that could temporarily increase noise in the environment and increase the potential for accidental ship strikes of Cook Inlet belugas. Any future hunts of Cook Inlet belugas will likely require a federal authorization and are not considered under the ESA definition of cumulative impacts.

6.0 DETERMINATION OF EFFECTS SUMMARY

6.1 HUMPBACK WHALE

This assessment determines that the proposed G&G project ***May Affect, but is Not Likely to Adversely Affect*** humpback whales because while the proposed geophysical activities do produce noise levels that could acoustically harass humpback whales, the noise levels are so low and the zones of ensonification are so small that relative to the rarity of humpback whales occurring in the Action Area, the risk of Level B harassment exposure is insignificant. The Level B harassment zones associated with geotechnical vibracoring are larger, but vibracoring activity lasts but one or two minutes, which is too short a period to cause hearing concerns associated with continuous noise activities. Finally, the most northern extent of the known humpback whale use area in Cook Inlet remains nearly 50 km (31 mi) south of the Action Area, and shutdown mitigation measures will be implemented should humpback whales be detected during the surveys.

6.2 BELUGA WHALE

This assessment determines that the proposed G&G project ***May Affect, but is Not Likely to Adversely Affect*** Cook Inlet beluga whales because of the possibility that beluga whales could be exposed to harassment-level noise associated with the proposed G&G activities. Although all of the Marine Terminal survey area and most of the pipeline survey area is located south of Critical Habitat Area 1, a small (28.5 km^2/11 mi^2) portion of the pipeline survey area does occur within Critical Habitat Area 1. Given the location and timing of planned work, ~~the potential~~it is not likely for one or more beluga whales to be exposed to sound pressure levels exceeding Level B harassment criteria. ~~cannot be considered insignificant or discountable.~~

Further, mitigation measures described in Section 4.5 will be implemented throughout the duration of the project to reduce beluga whales exposure to noise associated with the geophysical activity. Mitigation measures include vessel-based monitoring, safety radii, power-down procedures, shutdown procedures, ramp-up procedures, and speed or course alteration.

The proposed G&G Program is not expected to adversely affect the Cook Inlet beluga whale critical habitat. No permanent modifications from the seismic program on Cook Inlet beluga whale critical habitat are anticipated because the activities will be short-term and localized. No studies have demonstrated that G&G noise affects prey species of the Cook Inlet beluga whale, except when exposed to sound levels within a few meters of the source (in the case of airguns only) or in a few very isolated cases. Any impacts to prey species are expected to be short-term and fish would likely return to their pre-disturbance behavior once the G&G activity ceases. Additionally, the G&G Program will implement measures discussed in Section 4.6 to reduce impacts on beluga whale prey species.

6.3 STELLER SEA LION

This assessment determines that the proposed G&G project ***May Affect, but is Not Likely to Adversely Affect*** Steller sea lions because while the proposed G&G activities do produce noise levels that could acoustically harass Steller sea lions, the noise levels are so low and the zones of ensonification are so small that relative to the rarity of Steller sea lions occurring in the project area, the risk of Level B harassment exposure is insignificant. The Level B harassment zones associated with geotechnical vibracoring are larger, but vibracoring activity lasts but one or two minutes, which is too short a period to cause hearing concerns associated with continuous noise activities. Finally, the closest Steller sea lion haulout sites and rookeries are over 160 km (100 mi) south of the Action Area, and mitigation measures (e.g., shutdowns) will be implemented should Steller sea lions be detected during the surveys. The nearest Steller sea lion critical habitat (the 20-mile buffer around Nagahut Rocks) is also nearly 137 km (85 mi) south of the Action Area. The G&G project will have no effect on critical habitat.

7.0 ACRONYMS AND TERMS

Abbreviation	Definition
Abbreviations for Units of Measurement	
°C	degrees Celsius
°F	degrees Fahrenheit
cfs	cubic feet per second
cm	centimeters
cm^3	cubic centimeters
dB	decibels
dBA	A-weighted decibels
ft	feet
ft^2	square feet
gpm	gallons per minute
Hz	hertz
in^3	cubic inches
kHz	kilohertz
kg	kilogram
km	kilometer
km^2	square kilometer
kts	knots
L	liter
m^3	cubic meters
mg	milligrams
mg/L	milligrams per liter
mg/m^3	milligrams per cubic meter
mi	mile
mi^2	square mile
mm	millimeters
ms	millisecond

Abbreviation	Definition
MMTPA	million metric tons per annum
ppb	parts per billion
ppm	parts per million
psu	practical salinity unit
rms	Root mean square
mg	milligram
µg/kg	micrograms per kilogram
µPa	micropascals
Other Abbreviations	
§	section or paragraph
4MP	marine mammal monitoring and mitigation plan
ACC	Alaska Coastal Current
ADEC	Alaska Department of Environmental Conservation
ADNR	Alaska Department of Natural Resources
APDES	Alaska Pollutant Discharge Elimination System
Applicants	ExxonMobil Alaska LNG LLC, ConocoPhillips Alaska LNG Company, BP Alaska LNG LLC, TransCanada Alaska Midstream LP, and Alaska Gasline Development Corporation
CHA	Critical Habitat Area
DPS	Distinct Population Stocks
EMAP	Environmental Monitoring and Assessment Program
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FY	fiscal year
G&G	geotechnical and geophysical
IHA	Incidental Harassment Authorization
Liquefaction Facility	natural gas liquefaction
LLC	Limited Liability Company
LNG	liquefied natural gas
Mainline	An approximately 800-mile-long, large-diameter gas pipeline
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
North Slope	Alaska North Slope
NPDES	National Pollution Discharge Elimination System
PBTL	Prudhoe Bay Gas Transmission Line

Abbreviation	Definition
PBU	Prudhoe Bay Unit
PCPT	piezo-cone penetration testing
PIC	person-in-charge
PSO	Protected Species Observers
PTS	permanent threshold shift
PTTL	Point Thomson Gas Transmission Line
PTU	Point Thomson Unit
SSV	sound source verification
TTS	temporary threshold shift
U.S.	United States
USACE	U.S. Army Corps of Engineers
VGP	Vessel General Permit
ZOI	Zone of Influence

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